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LQM Technical Report #13 Computer Simulation Estimation of the Impact of Breast Cancer Screening April 5 2009

**Computer Simulation Estimation of the Impact of  
Various Breast Cancer Screening Intervals in  
Women of Various Ages**

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### **ABSTRACT**

**Background:** While randomized trials have shown that mammographic screening saves lives, critical questions concerns the optimal age of screening initiation and screening interval. **Methods:** A computer simulation model of breast cancer growth, spread, and detection, which could calculate the reductions in death and cost resulting from various screening intervals and ages of screening initiation. **Results:** The simulation revealed that breast cancer survival of 90+% appears to be achievable if women are screened annually. The American Cancer Society recommendation of yearly screening from age 40 appears to be a highly effective strategy, yielding a population-wide breast cancer survival of 88%, which corresponds to a 66% population-wide reduction in death compared to no screening. Less intensive screening strategies, such as screening every second or third year, not screening until age 50, or ending screening at 70 should yield markedly worse outcomes, while the pattern of screening used in the United Kingdom of every 36 months from age 50 to 70 is very ineffective, achieving only a 12% reduction in death. There appears to be no upper age limit for screening. A small additional reduction in the breast cancer death rate appears to be achievable by decreasing the screening interval to every six months, and by decreasing the age of screening initiation to age 30, but there appears to be little additional benefit from going beyond this. **Conclusions:** Prompt annual mammographic screening from age 40 appears to be capable of leading to considerable reductions in breast cancer lethality, with a small additional benefit to be derived from screening as frequently as twice a year from age 30.

**Keywords:** Breast Cancer, Survival, Screening, Mammography, Interval, Computer Simulation

## INTRODUCTION

In recent years, there has been much interest in finding ways to accurately quantify the burden of disease and the impact of various treatment choices on that burden, goals that have been embraced, with various degrees of enthusiasm, by the comparative effectiveness movement<sup>15</sup>. Comparative effectiveness research has been defined by a recent IOM report as “the generation and synthesis of evidence that compares the benefits and harms of alternative methods to prevent, diagnose, treat, and monitor a clinical condition or to improve the delivery of care. The purpose of CER is to assist consumers, clinicians, purchasers, and policy makers to make informed decisions that will improve health care at both the individual and population levels. The key elements of this definition are the direct comparison of effective interventions, the study of patients in typical day-to-day clinical care, and the aim of tailoring decisions to the needs of individual patients.<sup>5</sup> As articulated by a recent Congressional Budget Office report<sup>6</sup>, “an analysis of comparative effectiveness is simply a rigorous evaluation of the impact of different options that are available for treating a given medical condition for a particular set of patients” [one application of which would be] “the incorporation of any findings into computerized decision-support tools”. Similarly, as Carolyn Clancy has written<sup>7</sup> “Research on comparative effectiveness is a means, not an end. The ultimate goal is timely, relevant information for decision making.”

That breast cancer screening saves lives has been suggested,<sup>8-16</sup> with some dissenting voices,<sup>17,18</sup> by the results of randomized, controlled trials. The challenge is to learn how to use screening so as to achieve its maximum benefit.<sup>19-22</sup> Screening is recommended every year in the United States, every two years in much of Canada, Australia and Europe, every 18 months for women age 40-49 and every 24 months for women age 50 and older in Sweden, and every 3 years in the United Kingdom.<sup>23</sup> These diverse recommendations have arisen largely in isolation from empirical guidance as to the effect of the screening interval on mammography's capacity to reduce breast cancer death. Even in the context where a single recommendation prevails, such as the United States, there is a great variation in how screening is actually used.<sup>22,24</sup>

While the ultimate criterion for judging the impact of a medical procedure such as screening is the randomized trial, the trial provides an unwieldy tool for examining all of the permutations of age and screening intervals possible. Indeed, it might be argued that only two trials were carried out with the rigor and power to detect the difference in survival between a screening and non-screening group, and these trials took more than a decade for their results to become clear.<sup>10,16</sup> To calculate the relationship between the screening interval and the cancer survival rate, we have developed a biologically-based computer simulation model of cancer growth, spread, and detection.<sup>19,25-27</sup> We have also collected data<sup>28</sup> on the rate of breast cancer growth,<sup>29</sup> the sizes at which breast cancers become detectable on mammographic and clinical grounds,<sup>30</sup> and the relationship between tumor size and survival,<sup>31</sup> which can make the simulation a realistic tool for determining the consequences of various usages of screening.<sup>27</sup> Here we describe the application of this simulation method to the analysis of the impact various breast cancer screening intervals in women of various ages on the breast cancer survival rate.

## METHODS

### The simulation:

The simulation calculates the simultaneous change in tumor size, lethality, and detectability that occurs over time for breast cancer, and then estimates that likely survival rate for various women, particularly as regards age, under various usages of screening. The simulation does not consider the detection of ductal carcinoma in situ (DCIS), now ~20% of breast cancer cancers,<sup>32</sup> and thus probably provides a conservative estimate of the impact of screening on the breast cancer death rate.<sup>33</sup> The simulation was written in Visual Basic 6, and can be found at the end of this Technical Report.

The core of the simulation executes a recapitulation of the day-to-day increase in tumor cell number ( $N$ , Equation #1) and the chance of the lethal spread of breast cancer ( $L$ , Equation #2). The value of  $p$ , the probability, per cell, of an event of spread of breast cancer from the primary site in the breast to the periphery leading to death, for Equation #2, has been found<sup>31</sup> to be 2well captured by the expression:

$$(a) \quad p = 0.00005017 * N^{0.5575}$$

The value of  $g$  in Equation #1 is related to the tumor doubling time by the expression:

$$(b) \quad g = (2 \wedge (1 / \text{doubling time})) - 1$$

Unless otherwise stated, the *doubling time* used is the empirically based value of 130 days, as outlined in reference 29.

There is ample empirical support for the exponential growth of breast carcinomas,<sup>29,34-39</sup> as captured by Equation #1. There is also ample empirical support for the relationship between tumor size and risk of death that is captured by Equations #2.<sup>25,31</sup> Equation #2 is biologically plausible, as it has been derived from a consideration of the most generally accepted mechanism of breast cancer death, which is by the spread of cancer cells.<sup>40</sup> Equation #2 has also been found to accurately predict the relationship between tumor size and the risk of death in five separate populations of breast carcinoma patients, as well as in sub-populations of patients whose tumors were detected at screening.<sup>31</sup>

At each daily iteration, the simulation determines whether the tumor would be detectable on clinical grounds, if it has reached size  $Sp$ , while mammographic detection is set to occur at the time of screening, if tumors have reached size  $Sm$ . Values of  $N$  are converted into values of tumor diameter,  $D$ , by assuming spherical geometry and cellular density  $s$  (in cells/mm<sup>3</sup>), such that  $s=10^8$  cells/cc, based on data on the size of cancer cells.<sup>41-43</sup> Values for  $Sm$  and  $Sp$  are expressed in terms of distributions captured by 5-part step functions, each value of which is applicable to 20% of the population. For  $Sp$ , the values for five part step function are 9 mm, 14 mm, 20 mm, 26 mm, and 69 mm, based on the sizes of the cancers in the control (no screening) population in the Swedish Two-country trial of mammography,<sup>8-10,30</sup> while the distribution of values of  $Sp$  is captured by the five part step function with values of 3.5 mm, 5.5 mm, 7 mm, 9.2 mm, and 11.7 mm estimated from data on the sizes of the cancers seen at screening by the method in reference 30. The effect of age on this distribution is captured by multiplying each value with a *modifier*, such that the *modifier*=2.16025 - (*Age* \* 0.01785), again based upon empirical measures described in reference 30. This impact on the change in cancer detectability is believed to be due to the age-associated decrease that occurs in the radiographic density of the breast.<sup>44</sup>

The simulation uses age-specific data on cancer incidence<sup>45</sup> and life expectancy<sup>46</sup> to calculate the benefit and marginal benefit of screening from  $L$  in Equation #2. Values are derived in terms of both “years of life lost” and “cancer free years of life lost”. The latter combines both the years of life a woman with metastatic disease loses to cancer plus the years of life she will live with metastatic disease (on average, 5.74 years, for the women at this institution). Population-wide benefits expected in a population with the age structure in the USA were estimated using USA census data<sup>46</sup> (“USA reduction in death”), as well as for an imaginary population with a uniform distribution of ages (“un-age-structure-adjusted reduction in death”);

the latter allows a comparison of populations (such as US and UK) that have different age structures.

The simulation derived costs estimates, in terms of dollars/cancer free year of life saved, as determined by the direct cost of the mammogram and screening's indirect costs incurred by false positives.<sup>47</sup> Sickles and colleagues<sup>48,49</sup> found that screening mammograms can be carried out for \$50, while the year 2007 Medicare reimbursement is \$81.86, and insurance reimbursements above and below this value are common.<sup>50</sup> The cost ascribable to false positives have been found to be \$25.32/mammogram.<sup>51</sup>

The simulation calculates the consequences of screening at 3651 intervals (1 day to 10 years, plus no screening) for women ages 20 to 85 yielding 241,296 age/interval permutations. Permuting these into all possible life-long screening strategies leads to an enormous number of possibilities, almost all of which are inefficient, i.e., for most permutations, there is another permutation that can achieve a greater reduction in death with fewer mammograms. However, the small number of efficient strategies can be identified as those in which all individuals (i.e. all ages) receive the same marginal benefit, a technique known as the equimarginal method.<sup>52,53</sup> The simulation isolated 2200 such efficient strategies.

## RESULTS

### The core of the simulation captures the biology of breast carcinoma growth and spread.

The core of the simulation<sup>26,27</sup> executes a recapitulation of the day-to-day increase in the two key biological features of breast cancer: *tumor growth* and *lethal spread* (FIGURE 1).

*Tumor growth*: there is ample evidence<sup>34,38</sup> (summarized in reference 29) that over the range of sizes where breast cancer is seen clinically, the growth of breast cancer is exponential. For this reason, the simulation relies upon the day-to-day increase in tumor cell number (N) by the expression”

$$(1) \quad N_{today} = N_{yesterday} + (((2 \wedge (1 / doubling\ time)) - 1) * N_{yesterday})$$

*Lethal spread*: It is generally accepted that the principal mechanism of breast carcinoma death is the lethal spread of carcinoma cells from the primary site to the periphery, leading to fatal distant metastatic disease. We have found that such lethality is well captured by considering each primary tumor to be comprised of  $N$  cell, for which there is a probability,  $p$ , that a cancer cell will spread to the periphery, leading to death. It follows that the chance of one or more such events leading to death,  $L$ , will be:

$$(2) \quad L = 1 - e^{-Np}$$

The value of  $p$ , which we have derived from very large datasets on patients with breast carcinoma\*\*, is well captured by the expression:

$$(3) \quad p = 0.00005017 * N^{0.5575}$$

We have called this treatment of cancer lethality the *binary-biological model of cancer metastasis*. A full description of this approach can be found in reference \* and in Technical report #1 at <http://cancer.lifemath.net/about/techreports/index.php>, while the application of this framework to the analysis of breast carcinoma survival can be found in the other technical reports and references available at this website. Empirically, we have found the equations of the *binary-biological model of cancer metastasis* to provide highly accurate prediction of breast cancer lethality (within 1%), and to equally well capture the features of breast carcinoma and melanoma lethality in several very large datasets, containing information on hundreds of thousands of patients.

### The lethality of breast cancer changes dramatically over a short period of time

Thus, the simulation executes a recapitulation of the day-to-day increase in the chance of tumor size with Equation #1, and the day-to-day increase in the chance of death with Equation #2

The day-to-day increase in tumor size and lethality captured in the simulation by Equations#1 and #2 reveal an essential and unobvious feature of breast cancer biology: the chance of lethal metastatic disease does not increase gradually over time, but changes dramatically over a relatively short period. Furthermore, this dramatic change in lethality occurs when tumors reach sizes detectable by mammography. Thus, while 92% of 7 mm tumors are curable by local excision, by 1½ years later, when they have reached 18 mm, only 75% are still curable, and in an additional 1½ years, having reached 47 mm, only 33% are curable. This provides a likely explanation for why mammographic screening works: the rate of breast cancer growth, the probability of breast cancer spread, and the mammographic detectability of breast cancers, all have such fortuitous values that mammography is capable of finding tumors just before the point in time when there is an explosive increase in the fraction of cancers incurable by local treatment.

### **High levels of breast cancer survival should be achievable if women are screened frequently enough**

The simulation uses data on sizes at which breast cancer become detectable clinically and by mammography<sup>30</sup> to estimate the breast carcinoma death rate that can be expected when women attend screening at various frequencies (FIGURE 2). These results revealed that breast cancer survival of 90+% should be achievable, if women utilize screening at least once a year, and that even higher survival levels might be achieved by more frequent screening. In contrast, screening every three years would appear to achieve a more modest 80-90% survival, while screening every five years yields ~75% survival rate. The results also suggest that such reductions should be achievable for women of almost all ages examined, although the absolute amount of reduction in death increases as women age (the simulation incorporates information on the change in mammographic detectability as women age<sup>30,44</sup>).

### **The simulation results provide estimates of the benefit of screening**

The simulation uses data on cancer incidence<sup>45</sup> and life expectancy by age<sup>46</sup> to calculate the benefit, and marginal benefit, of screening (FIGURE 3). These calculations revealed that the benefit of screening may become a substantial extension in life, if allowed to accumulate over a woman's lifetime. For example, a group of women who begin annual screening at age 40 and who live until age 85 can expect to gain of 7.32 "months of life", and 8.67 "cancer free months of life" (see also TABLES I and II in the accompanying paper<sup>54</sup>).

### **The simulation results provide estimates of the reductions in death that can be expected for various lifelong screening strategies now in practice or under consideration**

The simulation combines the information on the impact of various screenings intervals for women of various ages (FIGURE 2) to estimate the population-wide impact of a number of lifelong screening strategies now in practice or under consideration (TABLES I-III, FIGURES 3-5). These simulation results revealed that the American Cancer Society recommendation<sup>13</sup> of yearly screening from age 40 is a highly effective strategy, yielding a population-wide 88% chance of breast cancer survival, which corresponds to roughly a 66% population-wide reduction in death, in comparison to women who do not use screening. The simulation also found that the pattern of screening used in the United Kingdom (every 36 months from age 50 to age 65) is probably capable of achieving only a 12% population-wide reduction in death. Annual screening from age 50 to age 70 appears capable of achieving a 25% population-wide reduction in death.<sup>55</sup> Twice-yearly screening from age 30 should appear capable of achieving a very high survival level (91% chance of breast cancer survival, which corresponds to a 74% reduction in death), but there appears to be very little advantage of more intensive patterns of screening (FIGURE 5).

### **The simulation identifies lifelong strategies that are efficient**

Only a very small number of the possible permutations of the screening interval for women of various ages are efficient, that is, can achieve the maximal reduction in death for the screening costs expended. However, it has long been known that for those few strategies that are efficient, all individuals will receive the same marginal benefit, a technique known as the equimarginal method.<sup>52,53</sup> 2200 such efficient strategies, with marginal benefits ranging from 294 to 0.04 cancer free hours of life saved per mammogram were identified by the simulation (TABLE I). The relationship between average number of mammograms used per year and the population-wide reduction in death expected for these 2200 efficient strategies is shown in the thick gray line in FIGURE 4. Screening strategies that lie close to this grey line are efficient, while those strategies below this line are inefficient, that is, one could achieve greater reductions in death with the same resources simply by using the efficient strategy with that cost. Note that the ACS recommendation of annual screening from age 40 is an efficient use of screening

resources, as is twice-yearly screening from age 30, while the UK recommendation for screening every three years from age 50 to 70, and annual screening from age 50 to age 70, are inefficient uses of resources (FIGURE 4).

### **The simulation provides information for choosing among the efficient lifelong strategies**

Which of the 2200 *efficient* lifelong screening strategies might be the *best* strategy? While such a choice is ultimately an arbitrary societal decision based upon the degree of benefit that women desire from screening, and the cost that they are willing to pay for this benefit, the simulation provides quantitative information which can be used to guide such a choice.

The simulation revealed that the choice of the optimal screening interval is greatly simplified by a very fortuitous feature of the marginal cost curve: there is a very dramatic change in the slope of the curve right at around 6 months (FIGURE 6). Thus, almost all of the strategies that involve screening up to once every six months give very good returns on the expenditures involved, while almost all of the strategies that involve screening much more frequently than once every six months are prohibitively expensive (FIGURE 6). To picture this in more practical terms, the simulation results indicate that if a woman age 65 chose to attend screening every 12 months, she will be receiving a marginal benefit of 27 extra cancer free hours of life per mammogram, and thus will be getting many more hours of life from screening than she is losing every time she goes for a mammogram. In economic terms, she will also be receiving a good return on the \$50 to \$200 that her mammogram probably costs. If, on the other hand, she chose screening every 3 months, she would be receiving a marginal benefit of only about 1 cancer free hour of life, and will be spending more time *at* her last exam than she would be gaining in cancer free hours of life *from* the exam! Clearly, the best choice would appear to lie somewhere in between. A reasonable compromise strategy would appear to be a marginal benefit of about 5 extra cancer free hours of life. Such a strategy would yield an average benefit per woman of ~9 extra cancer free months of life and a population-wide 91% chance of surviving breast cancer (TABLE I).

The 5-hour marginal benefit strategy would involve screening every 29 months beginning at age 20, then every 12 months at age 30, every 6 months at from ages 50 to age 60, every 6 months at age 70, and every 8 months at age 80 (TABLE I). While the 5-hour marginal benefit strategy is ideal in many ways, it is, admittedly, rather too complex for practical implementation. Fortunately, however, the simulation shows us that there is a much less complex schedule that is close enough to the 5-hour marginal benefit strategy to deliver almost the same benefit at almost the same cost: twice-yearly screening from age 30 (TABLE I). Clearly, twice-yearly screening from age 30 is simpler to remember, communicate, and put into effect than the ideal 5-hour marginal benefit strategy, but achieves almost the same reduction in breast cancer death with almost the same cost.

### **The simulation provides information on the costs of screening**

The simulation revealed that under virtually all of cost assumptions (\$50, \$100, and \$200 per mammogram, with and without the costs of false positives<sup>51</sup>) the cost of screening is comparable to, or cheaper than, many other medical interventions (TABLE II). At a \$100 per mammogram, and including the costs of false positives, yearly screening from age 40 delivers each cancer free year of life at a cost of less than \$15,000, while twice-yearly screening from age 30 delivers each cancer free year of life for ~\$45,000. In contrast, heart transplantation costs ~\$100,000/year of life saved while dialysis has been estimated to cost ~\$20,000-\$46,000/year of life saved.

The reduction in breast cancer death also brings savings, both in the avoidance of the medical costs associated with metastatic disease, as well as prevention of lost economic productivity due to premature death. Max has estimated the medical cost of metastatic disease to be \$52,288/woman, while lost productivity cost associated with premature death is



\$272,000/woman (personal communication).<sup>56</sup> Using these values, the simulation revealed that for programs that carry out mammograms for \$100 each, the saved medical and productivity costs will pay for 75% of the cost of annual screening from age 40. Where mammograms can be carried out for \$50, the savings in medical costs and lost productivity achieved by annual screening from age 40 actually saves money, returning an average reward to society of \$43/woman (TABLE III). The savings associated with metastatic disease alone pays for about 40% of the cost of annual screening from age 40. In fact, at \$50 per mammogram, the medical and productivity savings achieved by screening will pay for screening as frequently as twice a year from age 30 (TABLE III).

**Sensitivity analysis.**

We examined whether small changes in the underlying assumptions would greatly change the final outcomes predicted by the simulation, but found the results to be only moderately affected by the precise values used for growth rate, tumor detectability, and cost (FIGURE 6, TABLES II and III). For example, there was relatively little impact on the marginal cost curve whether the doubling time chosen for the simulation was 130 days, chosen from actual measurements of the breast cancer growth rate by our group and others,<sup>29, 39</sup> or half (65 days) or double (260 days) the 130 day value (FIGURE 6), (and none of the experimental measurements of breast cancer growth exceed these values<sup>29,39</sup>) as well as when the simulation was run with a range of doubling time values with a 100 day standard deviation around the 130 day median value (data not shown).

## DISCUSSION

The simulation used here can be thought of as a very elaborate calculator for incorporating what is known about the rate of breast cancer growth,<sup>29</sup> the probability of lethal spread,<sup>30</sup> and the sizes at which breast cancers become detectable by mammography and on clinical grounds<sup>31</sup> to predict the outcome of various usages of screening. There are no imagined assumptions in the calculations. Thus, the simulation provides what Gazelle and his colleagues have called a “biologically based deep model,”<sup>57</sup> and the results generated by simulation can be considered the direct, if perhaps unobvious, consequences of what we now know about breast cancer growth, spread, and detectability. A number of these consequences stand out: **First**, the simulation results suggest that the ACS recommendation of yearly screening from age 40 is a highly effective strategy, yielding a 66% reduction in death (un-age-adjusted). **Second**, the simulation results suggest that less intensive screening strategies, such as screening every second or third year, not screening until age 50, or ending screening at 70, should yield markedly worse outcomes. In particular, the simulation results suggest that the pattern of screening used in the United Kingdom (every 36 months age 50-70) is very ineffective, achieving only a 12% reduction in death. **Third**, the simulation results suggest that there is no upper age limit for screening. We have used the simulation to predict the effect of screening in women up to age 85, and even at this age, the simulation results suggest that these women should benefit from screening. **Fourth**, the simulation results suggest small additional reductions in the breast cancer death rate might be achievable by decreasing the screening interval down to as frequently as every six months, and by decreasing the age of screening initiation down to as young as age 30, but that little additional benefit would be gained by going beyond these points.

The simulation results indicate that the ACS recommendation of annual screening from age 40 should lead to a population-wide 88% survival rate, while that twice-yearly screening from age 30 should result in a survival rate of 91%. Both strategies are also a highly effective and cost-efficient, providing one of our cheapest tools for preventing premature death. Since the current level of breast cancer survival is about 55-70%,<sup>11,13</sup> this means that adherence to the current ACS recommendation should translate into tens of thousands of lives being saved every year. Unfortunately, this is rarely the case, with very negative consequences.<sup>14,19,22,24</sup> Furthermore, as there are approximately 180,000 breast cancer cases in the US each year,<sup>11,13</sup> these findings also indicate that twice-yearly screening from age 30 should translate into an additional 5000 lives that might be saved. It is of interest that ~5% of invasive breast cancers, and ~10% of the years of life lost to breast cancer, occurs in women younger than 40.<sup>45,46</sup> Furthermore, as we have previously reported,<sup>44</sup> an analysis of the radiographic density of the breast in women as young as 30 indicates that screening at this age should be capable of finding many cancers at smaller, and thus less lethal, sizes, than is currently the case.<sup>58</sup> It is also of interest that while 12% of the invasive breast cancers seen among the women who had used screening at this institution appeared as palpable masses within a year of a negative mammogram, ~3/4<sup>th</sup> of these appeared in the last 6 months of that first year.<sup>28,29,59,60</sup> Indeed, an analysis of the rate of appearance of these larger, more lethal, clinically detected cancers has revealed that their appearance is reduced only within the first ~6 months of negative mammogram; from ~9 months onward these larger, more lethal tumors emerge at a regular and constant rate.<sup>29</sup> Thus, the simulation results suggest that major reductions in breast cancer death can be expected from two actions: **first**, if we implement simple interventions, such as patient tracking and reminding,<sup>61</sup> which will lead to greater adherence to the current screening recommendation of annual screening from age 40, and **second**, if we change the national screening recommendation to twice yearly mammography from age 30.

### FIGURE LEGENDS

**FIGURE 1. Simultaneous calculation of breast cancer growth.** Shown are the median tumor sizes detectable by screening mammography and detectable in the absence of screening.

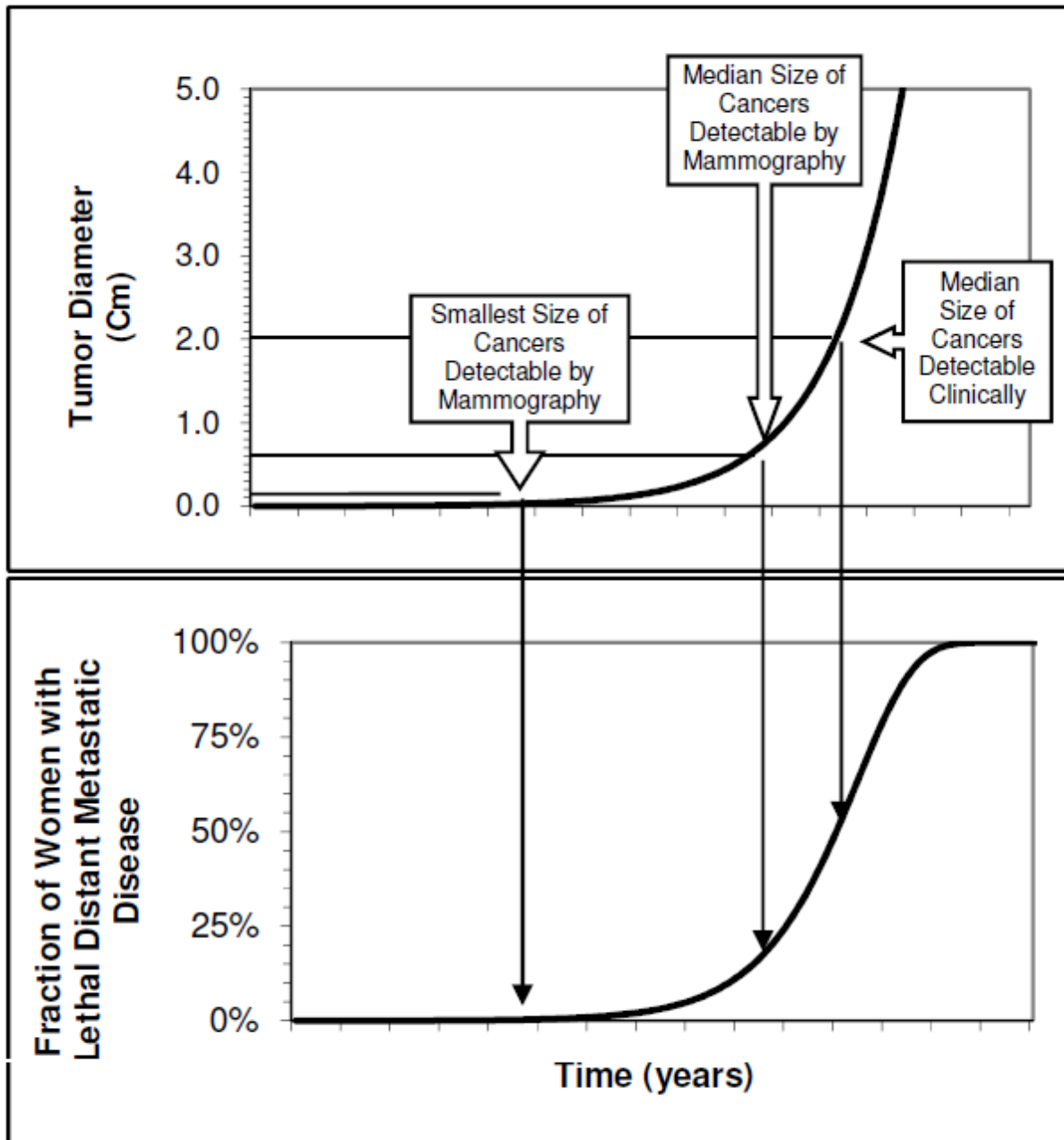
**FIGURE 2. Expected relationship between the screening interval and the fraction of women with distant metastatic disease for women of various ages, based upon estimates of the tumor doubling time, mammographic and non-mammographic detectability of breast cancers extracted from the MGH dataset.**

**FIGURE 3. The benefit of screening, per year, in terms of years of life saved (3A) and cancer free years of life saved (3B).**

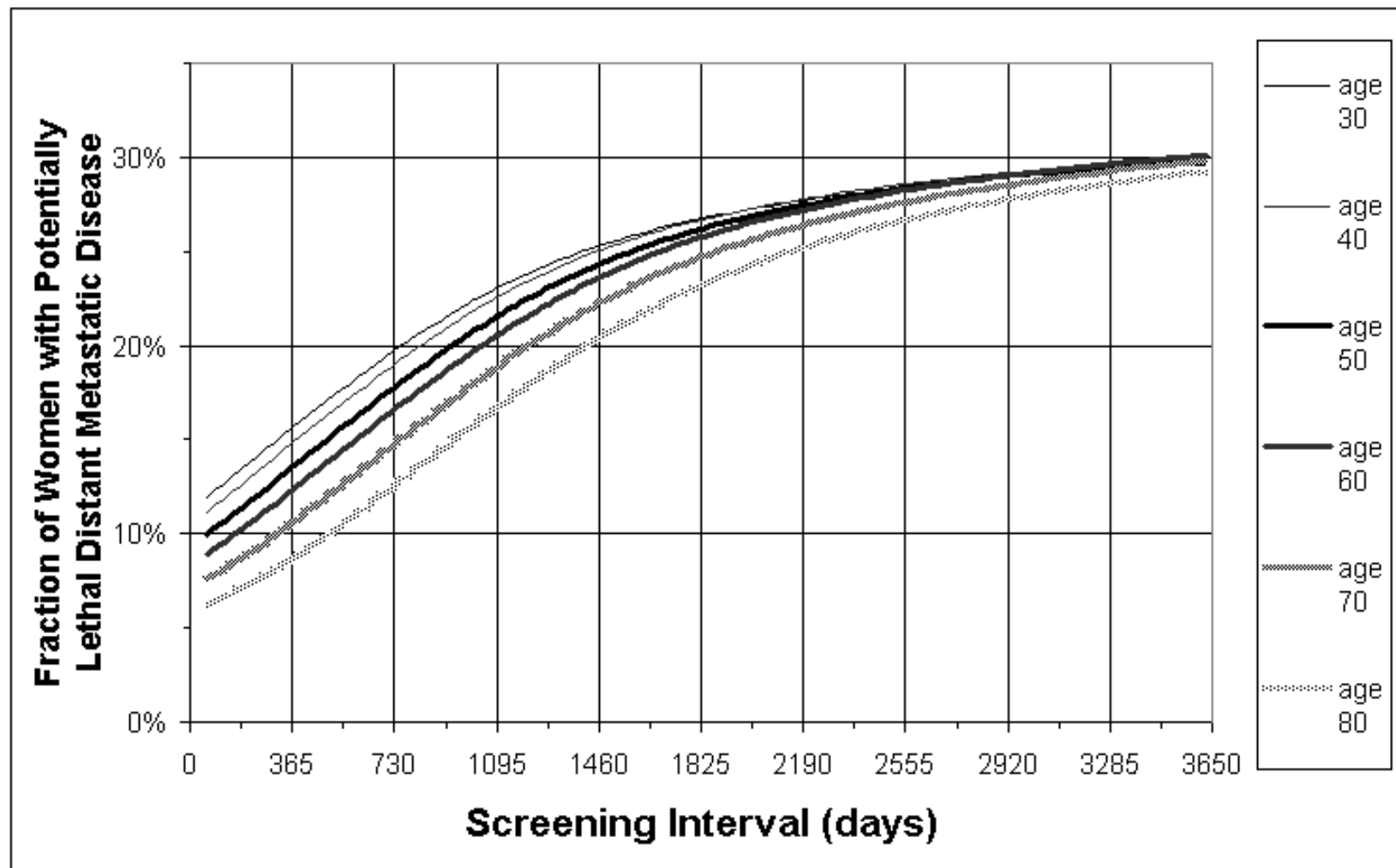
**FIGURE 4. Curve of the reduction in breast cancer death versus the annual screening costs (based upon a cost per mammogram of \$50), for the most *efficient* screening strategies calculated by the equimarginal method, as well as a number of other screening strategies either currently in use or under consideration.**

**FIGURE 5. Three-dimensional display of the effects of various screening intervals, begun at various ages, on the expected un-age adjusted population-wide reductions in breast cancer death.**

**FIGURE 6. Marginal benefit of screening, for women age 65, for the most probable breast carcinoma doubling time (130 days) as well as for half (65 days) and double (260 days) that doubling time estimate.**

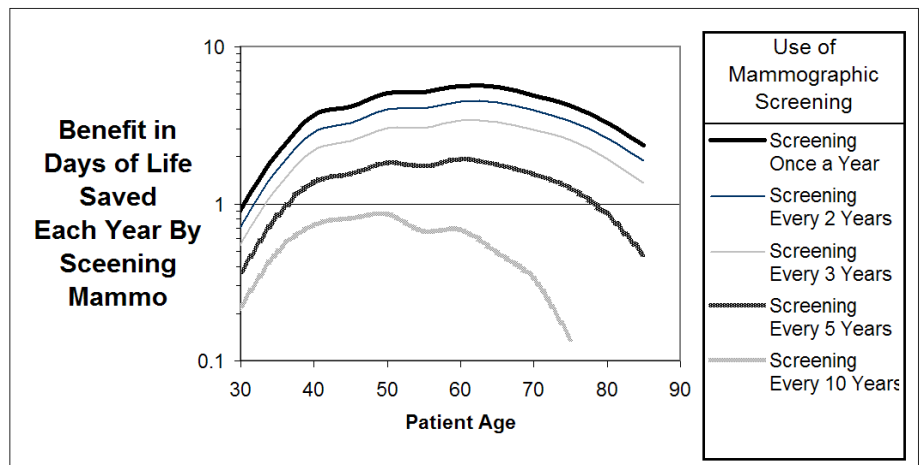


**FIGURE 1**  
Simultaneous Calculation of Breast Cancer Growth

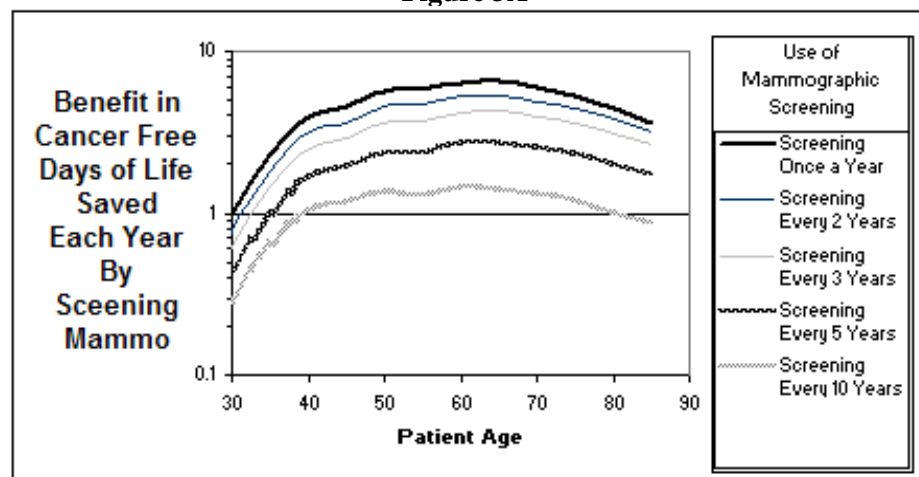


**FIGURE 2**

Expected Relationship Between the Screening Interval and the Fraction of Women with Distant Metastatic Disease



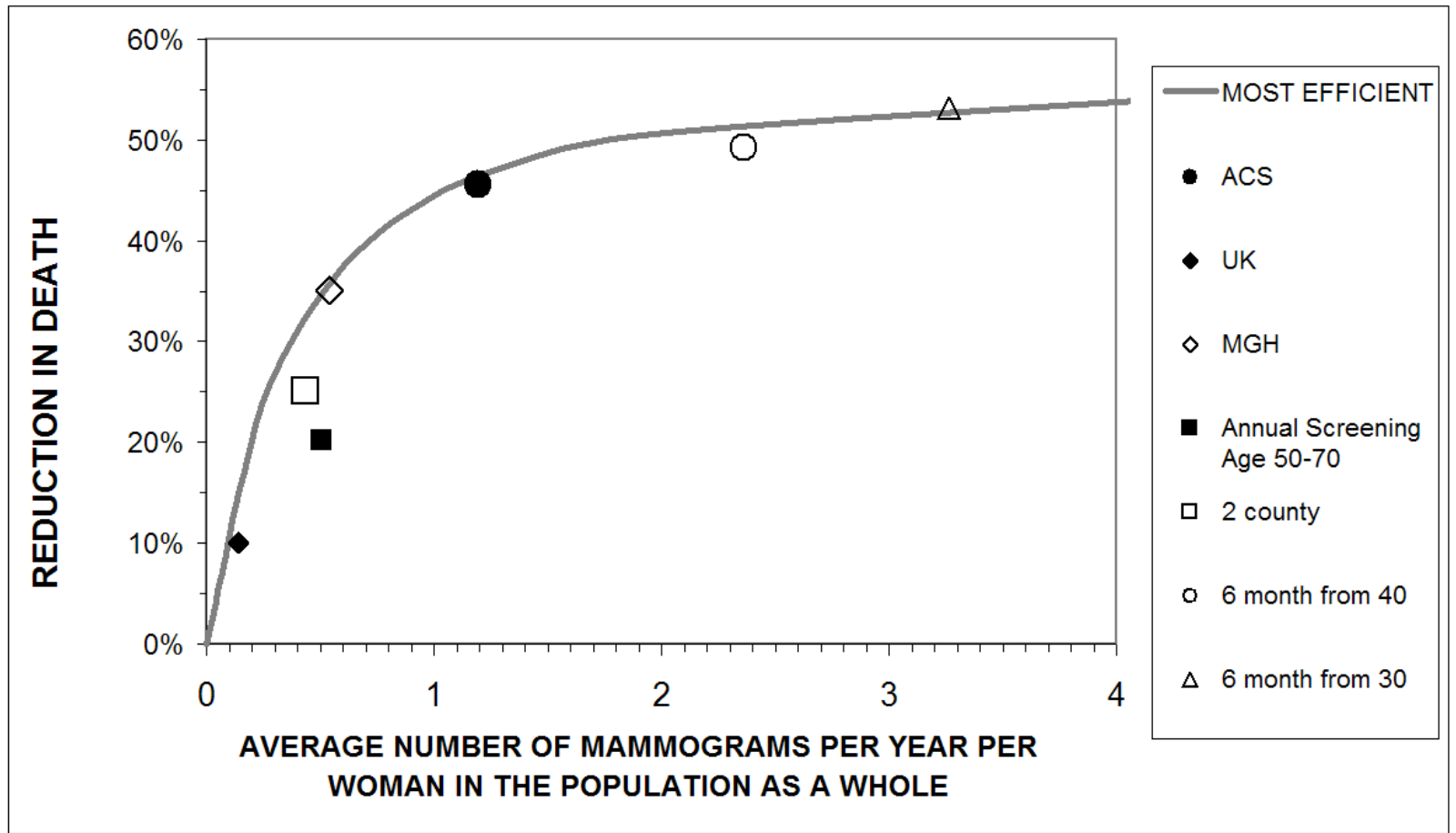
**Figure 3A**



**Figure 3B**

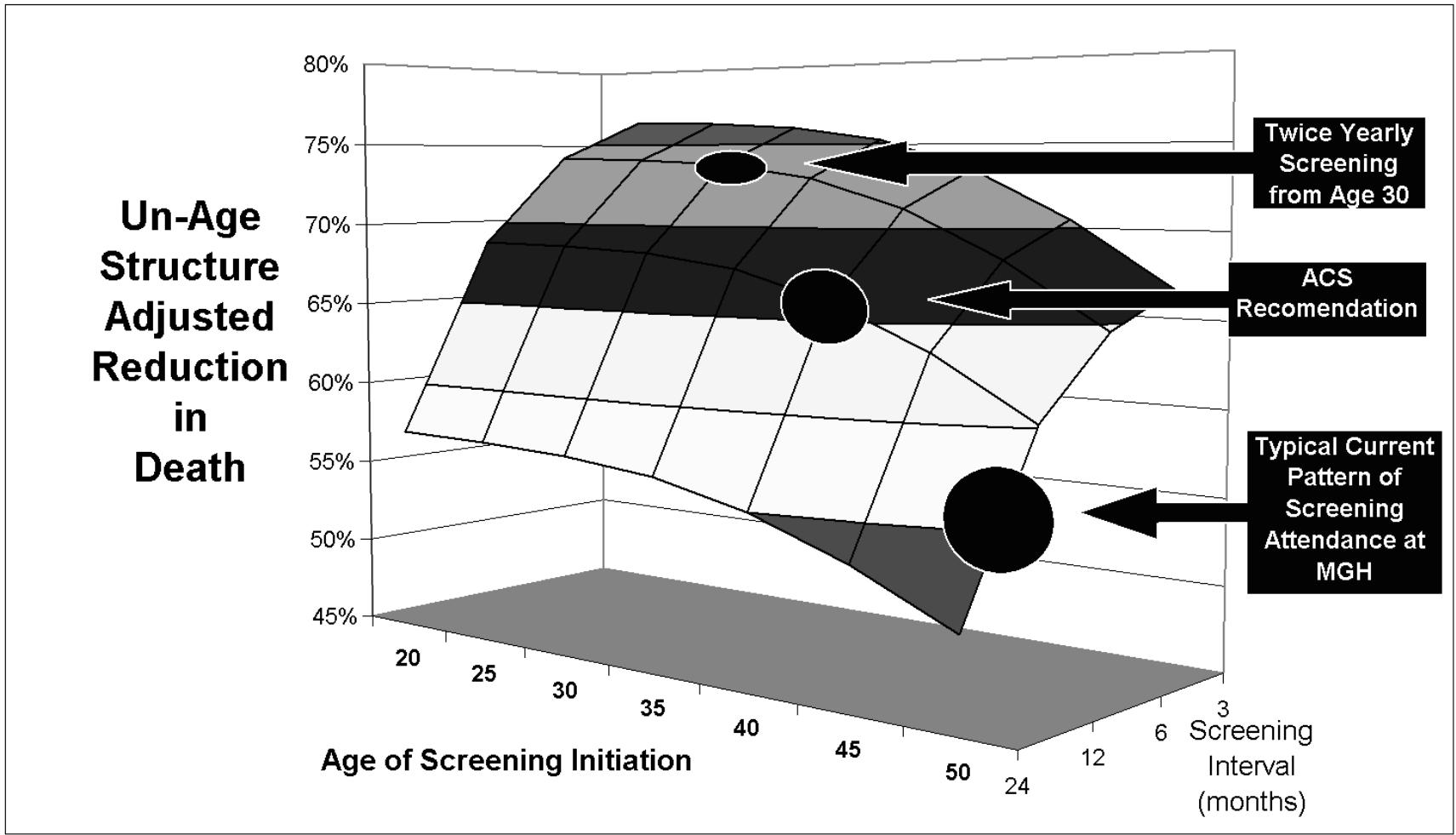
**FIGURE 3**

**The Benefit of Screening, Per Year, in Terms of Years of Life Saved (3A) and Cancer Free Years of Life Saved (3B)**



**FIGURE 4**

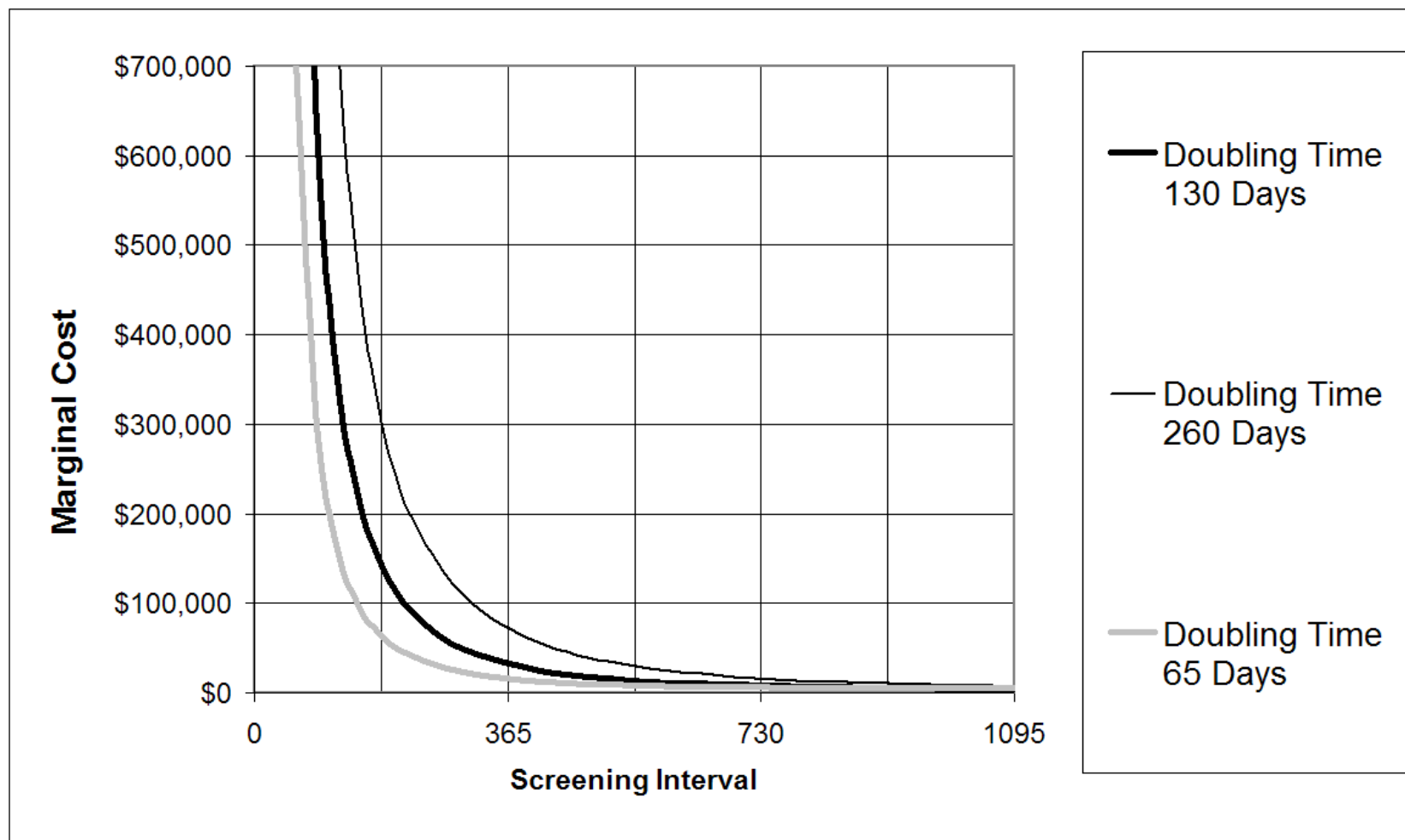
Reduction in Breast Cancer Death Versus the Annual Screening Costs, for the Most *Efficient* Screening Strategies



**FIGURE 5**

The Effects of Various Screening Intervals, Begun at Various Ages, on the Expected Un-Age Adjusted Population-Wide Reduction in Breast Cancer Death





**FIGURE 6**

Marginal Benefit of Screening, for Women Age 65, For the Most Probably Breast Carcinoma Doubling Time (130 Days) as Well as for Half and Double that Doubling Time Estimate

**TABLE I**  
**The Consequences of Various Life-Long Screening Strategies, as Determined by Computer Simulation Analysis**

	Marginal Benefit (hours of life saved for the last mammogram)	SCREENING INTERVAL (MONTHS)							Reduction in Br Ca death (un-age- structure- adjusted)	Reduction in Br Ca death (USA population)	Survivors	Average Benefit (To Each of the Women in the Population as a whole, in cancer free years of life saved)	Average Benefit (To Each of the Women found to have breast cancer, in cancer free years of life saved)	Marginal Benefit (hours of life saved for the last dollar spent on screening)	Marginal Cost (in dollars, for the last cancer free years of life saved (USA population)	Average Screening Costs (in dollars per cancer free years of life saved) (USA population)	Program Screening Costs (screening dollars per woman per year averaged over the whole USA population of women over age 20)
		age 20	age 30	age 40	age 50	age 60	age 70	age 80									
Most Efficient Strategies Estimated by the Equimarginal Method	-	none	none	none	none	none	none	none	0%	0.0%	65.1%	-	-	-	-	-	\$0
	283	none	none	none	none	51	54	none	10%	7.9%	68.6%	0.09	0.52	5.66	\$1,548	\$994	\$2
	270	none	none	none	none	46	49	none	15%	10.9%	70.2%	0.12	0.70	5.40	\$1,622	\$1,010	\$3
	254	none	none	none	none	43	45	none	20%	13.9%	72.0%	0.14	0.87	5.08	\$1,724	\$1,009	\$3
	240	none	none	none	none	40	43	60	25%	17.1%	73.7%	0.18	1.09	4.80	\$1,825	\$1,064	\$4
	229	none	none	none	116	39	41	55	30%	20.1%	75.3%	0.21	1.30	4.58	\$1,913	\$1,109	\$5
	212	none	none	none	44	36	38	49	35%	23.3%	77.1%	0.25	1.50	4.24	\$2,066	\$1,154	\$6
	189	none	none	none	38	33	35	44	40%	26.1%	78.8%	0.29	1.73	3.78	\$2,317	\$1,214	\$7
	160	none	none	none	33	30	32	39	45%	30.5%	80.6%	0.36	2.16	3.20	\$2,738	\$1,448	\$10
	125	none	none	36	28	26	28	34	50%	34.6%	82.3%	0.42	2.57	2.50	\$3,504	\$1,685	\$13
	91	none	none	28	23	22	24	29	55%	38.7%	84.1%	0.49	2.96	1.82	\$4,813	\$2,046	\$16
	60	none	none	22	19	18	19	23	60%	42.7%	85.9%	0.55	3.33	1.20	\$7,300	\$2,596	\$22
	34	none	120	16	14	13	15	18	65%	46.6%	87.6%	0.61	3.70	0.68	\$12,882	\$3,536	\$30
	15	none	22	10	9	9	10	12	70%	50.5%	89.4%	0.67	4.07	0.30	\$29,200	\$5,966	\$48
	13	none	20	10	8	8	9	12	70.7%	51.0%	89.6%	0.680	4.12	0.25	\$35,000	\$6,002	\$52
	11	none	18	9	8	8	9	11	71.2%	51.4%	89.8%	0.686	4.16	0.22	\$40,000	\$6,322	\$56
	10	none	17	8	7	7	8	10	71.7%	51.7%	90.0%	0.691	4.19	0.19	\$45,000	\$6,628	\$59
	9	none	16	8	7	7	8	10	72.1%	52.1%	90.2%	0.697	4.23	0.17	\$51,250	\$7,756	\$63
	8	none	15	8	7	7	8	10	72.4%	52.3%	90.2%	0.700	4.25	0.16	\$55,000	\$8,397	\$66
	7	none	14	7	6	6	7	9	72.9%	52.8%	90.4%	0.708	4.29	0.13	\$65,000	\$10,127	\$72
6	35	13	7	6	6	7	8	73.3%	53.1%	90.6%	0.713	4.32	0.12	\$75,000	\$11,033	\$78	
5	29	12	6	5	5	6	8	73.8%	53.5%	90.7%	0.719	4.36	0.10	\$90,000	\$11,895	\$85	
4	25	11	5	5	5	5	7	74.3%	53.8%	90.9%	0.724	4.39	0.08	\$110,000	\$12,809	\$94	
3	21	9	5	4	4	5	6	74.9%	54.3%	91.1%	0.731	4.43	0.06	\$146,000	\$14,456	\$107	
2	17	8	4	3	3	4	5	75.6%	54.9%	91.4%	0.740	4.49	0.04	\$220,000	\$17,261	\$132	
1	12	5	3	2	2	3	4	76.5%	55.6%	91.7%	0.751	4.55	0.02	\$440,000	\$23,428	\$185	
UK	-	none	none	none	36	36	none	none	12%	10%	68.9%	0.15	0.89	-	-	\$1,353	\$4
MGH-actual	-	none	none	none	17	17	17	17	56%	35%	84.6%	0.36	2.18	-	-	\$1,707	\$14
ACS	-	none	none	12	12	12	12	12	66%	46%	88.1%	0.56	3.38	-	-	\$2,978	\$30
12 months 40-70	-	none	none	12	12	12	12	none	33%	29%	76.4%	0.46	2.76	-	-	\$3,489	\$24
NCI	-	none	none	none	12	12	12	12	60%	38%	85.9%	0.39	2.35	-	-	\$2,225	\$19
12 months 50-70	-	none	none	none	12	12	none	none	25%	20%	73.7%	0.27	1.66	-	-	\$2,473	\$13
2 COUNTY	-	none	none	24	33	33	33	none	29%	25%	75.0%	0.36	2.20	-	-	\$1,916	\$11
6 month from 40	-	none	none	6	6	6	6	6	71%	49%	89.8%	0.61	3.67	-	-	\$5,415	\$59
6 month from 30	-	none	6	6	6	6	6	6	74%	53%	90.7%	0.71	4.28	-	-	\$8,948	\$82

Estimates based upon a breast cancer doubling time of 130 days; Costs based upon a per mammogram cost of \$50. For other values, see TABLE II. Note that survival values are for the population as a whole, that is, including both the women screened and the women who are not screened.

**TABLE II**

	Reduction in death (USA population)	Cost, in dollars per cancer free year of life saved (USA population) at \$50 Per Mammo	Cost, in dollars per cancer free year of life saved (USA population) at \$50 Per Mammo Plus False Positive Costs	Cost, in dollars per cancer free year of life saved (USA population) at \$100 Per Mammo	Cost, in dollars per cancer free year of life saved (USA population) at \$100 Per Mammo Plus False Positive Costs	Cost, in dollars per cancer free year of life saved (USA population) at \$200 Per Mammo	Cost, in dollars per cancer free year of life saved (USA population) at \$200 Per Mammo Plus False Positive Costs	Cost, in dollars per year of life saved
Screening Mammography (UK): Every 36 months age 50-70	10%	\$2,706	\$4,059	\$5,412	\$6,765	\$10,824	\$12,177	
Screening Mammography (ACS): Every 12 months from age 40	46%	\$5,956	\$8,934	\$11,913	\$14,891	\$23,825	\$26,803	
Screening Mammography: Every 12 months age 40-70	29%	\$6,979	\$10,468	\$13,958	\$17,447	\$27,916	\$31,405	
Screening Mammography: Every 12 months from age 50	38%	\$4,449	\$6,674	\$8,898	\$11,123	\$17,797	\$20,021	
Screening Mammography: Every 12 months age 50-70	20%	\$4,947	\$7,420	\$9,894	\$12,367	\$19,788	\$22,261	
Screening Mammography: Swedish 2 County Trial	25%	\$3,831	\$5,747	\$7,662	\$9,578	\$15,325	\$17,241	
Screening Mammography: Every 6 months from age 40	49%	\$10,830	\$16,246	\$21,661	\$27,076	\$43,322	\$48,737	
Screening Mammography: Every 6 months from age 30	53%	\$17,896	\$26,844	\$35,792	\$44,740	\$71,585	\$80,533	
FOCBT every year + sigmoidoscopy every 3 years age 65+								\$43,000
Adjuvant chemotherapy, stage I node (-) breast cancer								\$24,000
Lovastatin treatment for men age 45-54 for hyperlipidemia								\$34,000
Heart Transplantation for patients age 50 with terminal disease								\$100,000
AZT for people with AIDS								\$26,000
Influenza vaccination for all citizens								\$140
Home dialysis for chronic end-stage renal disease								\$20,000-\$46,000
3-Vessel coronary bypass graft surgery								\$12,000-\$100,000
Kidney transplantation for renal disease								\$17,000-\$29,000

C:\Triple modified april25\Data Files\All Women\ [JANv3cT-modified march 9 2001.xls]Table II for paper#4!\$AL\$90

For comparison, the cost/year of healthy life gained has been estimated to be US\$ 46 249 for renal dialysis and US\$ 113 087 for coronary artery bypass surgery in the USA (Schulman et al, 1991).

American society generally accepts treatments as appropriate if they cost less than about \$50,000 per quality-adjusted life-year gained. However, the notion of quality-adjusted life-years is complex, explains Dr. Deyo. One would not want to give the same credit to a lifesaving treatment that leaves somebody blind for the next 10 years as one that leaves a person with perfect vision for the next 10 years. It is not simple to measure the cost part of the ratio either, further complicating the issue of cost-effectiveness. For instance, the charge for direct medical care is not the same as the total care costs for an illness. Finally, there is the issue of opportunity costs. This refers to the fact that if we spend our money doing one thing, we cannot spend it for doing something else. For example, if an extra \$500 million is spent on bypass surgery, there is \$500 million less for prenatal care, cancer screening, or other services.

See "Cost-effectiveness of primary care," by Dr. Deyo, in the January 2000 Journal of the American Board of Family Practice 13(1), pp. 47-54.

**TABLE III**

	SCREENING INTERVAL (MONTHS)							Reduction in death (USA population)	Survivors	Cost, in dollars per cancer free years of life saved (USA population)	Program Screening Costs at \$50 Per Mammogram	Program Screening Costs at \$100 Per Mammogram	Program Screening Costs at \$50 Per Mammogram (after taking account savings for preventing metastatic disease)	Program Screening Costs at \$100 Per Mammogram (after taking account savings for preventing metastatic disease)	Program Screening Costs at \$50 Per Mammogram (after taking account savings for preventing metastatic disease and loss of productivity)	Program Screening Costs at \$100 Per Mammogram (after taking account savings for preventing metastatic disease and loss of productivity)
	20	30	40	50	60	70	80									
<b>i</b>	none	none	none	none	none	none	none	0%	65.1%	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>a</b>	none	none	none	36	36	none	none	10%	68.9%	\$1,353	\$4	\$7	\$2	\$5	-\$9	-\$5
<b>b</b>	none	none	none	17	17	17	17	35%	84.6%	\$1,707	\$14	\$27	\$4	\$17	-\$48	-\$34
<b>c</b>	none	none	12	12	12	12	12	46%	88.1%	\$2,978	\$30	\$60	\$18	\$48	-\$43	-\$13
<b>d</b>	none	none	12	12	12	12	none	29%	76.4%	\$3,489	\$24	\$48	\$18	\$42	-\$12	\$12
<b>e</b>	none	none	12	12	12	12	12	38%	85.9%	\$2,225	\$19	\$38	\$8	\$27	-\$47	-\$28
<b>f</b>	none	none	12	12	12	12	12	20%	73.7%	\$2,473	\$13	\$25	\$8	\$21	-\$14	-\$2
<b>g</b>	none	none	24	33	33	33	none	25%	75.0%	\$1,916	\$11	\$22	\$6	\$17	-\$20	-\$9
<b>h</b>	none	6	6	6	6	6	6	49%	89.8%	\$5,415	\$59	\$118	\$47	\$106	-\$19	\$40
<b>h</b>	none	6	6	6	6	6	6	53%	90.7%	\$8,948	\$82	\$163	\$69	\$150	\$1	\$82

AGE →

UK  
MGH  
ACS  
12 months 40-70  
NCI  
12 months 50-70  
2 COUNTY  
6 month from 40  
6 month from 30

C:\My Documents (Simulation)\\_\_\_\_\_ Word Files 4 07 with chemo\cost of met\JANv3cT-modified march 9 2001.xls\Table Including Savings 7 (3)!

## CODE

```
Attribute VB_Name = "Module1"
Sub main()
'   James Michaelson      michaelj@helix.mgh.harvard.edu
'   Personal Communication: please do not pass along without permission
'   A program to give:
'       The curves of:
'           : "death rate" versus "screening interval"(by age)
'           : "reduction in death rate" vs. "screening interval"(by age)
'           : cost and marginal costs
'           : tables of optimal screening strategies
'   in order to interpret the results of the latest data collection from the MGH
database
'   _____

'FIRST, we'll dimension the array variables, and define the important
constants

' THE NEXT 2 lines CALCULATE THE TOTAL NUMBER OF MAMMO'S GIVEN TO THE
POPULATION
Dim MammoTotal(2200) As Single
Dim AgeAdjustedMammoTotal(2200) As Single

' We'll need the next three variables to make calculations for common, but
inefficient,
'       patterns of screening such as the ACS recommendation, UK pattern,
etc.
Dim Pattern As Integer
Dim PatternName(2200) As String
Dim IndicatedInterval(2200, 90) As Integer

' x is s simple marker to keep track of the screening interval that
'       corresponds to marginal cost, zeta lets us keep track of "none's"
Dim x As Integer
Dim zeta As Integer
Dim zeta2 As Integer
'   the "UnAgeAdustedOverallAVERAGECOST" is the average cost for a group of 65
women,
'       each of a different age, from age 20 to age 85, for each
marginal cost.
'   the "USAAgeAdustedOverallAVERAGECOST" is the average cost for a population
of women
'       with the age structure of the USA, for each marginal cost
Dim UnAgeAdustedOverallAVERAGECOST(2200) As Single
Dim USAAgeAdustedOverallAVERAGECOST(2200) As Single

' MinAGE and MaxAGE are the youngest and oldest ages that we will make
calculations for
Dim MinAGE As Integer
Dim MaxAGE As Integer
MinAGE = 20
MaxAGE = 85

'AgeStructureAdjustemnt allows us to calculate effect on USA population of
women
Dim AgeStructureAdjustemnt(99)
```

```

' below are the (Cancer Free) years of life saved for woman as a whole,
'           and for the womenwho will get breast cancer
Dim PopulationWideYLS(2200) As Single
Dim CancerPatientsYLS(2200) As Single

'the following string allows me to put a label at the top of every file
Dim title As String
title = "all ages 20-85, for doubling time 130"
' , density 4"
'"Duffy-Tabar growth rate estimates"
'"Simulation for All Women"

'doublingtime is the tumor doubling time, discovered through anlysis of the
MGH data
doublingtime = 130

'testcost is the cost for each mammography exam (in $)
testcost = 100

'the next three variables are for:
' "INCIDENCE", the cancer indence, and
' "YLL", (Years of Life Left)=years of life saved by preventing a death from
breast cancer, and
' "AGEfraction", for the fraction of women of this age in the population,
' all by age. They are derrived from standard references, as noted
below
Dim INCIDENCE(90) As Single
Dim YLL(90) As Single
Dim AGEfraction(90) As Single

' INCIDENCE data from the SEER national database, as quoted in Kopans "Breast
Imaging", 2nd Edition
For Age = MinAGE To MaxAGE
If Age >= 20 Then INCIDENCE(Age) = (5 / 100000) + ((1 / 5) * (Age - 20) *
((7.2 - 5) / 100000))
If Age >= 25 Then INCIDENCE(Age) = (7.2 / 100000) + ((1 / 5) * (Age - 25) *
((27 - 7.2) / 100000))
If Age >= 30 Then INCIDENCE(Age) = (27 / 100000) + ((1 / 5) * (Age - 30) *
((66 - 27) / 100000))
If Age >= 35 Then INCIDENCE(Age) = (66 / 100000) + ((1 / 5) * (Age - 35) *
((129 - 66) / 100000))
If Age >= 40 Then INCIDENCE(Age) = (129 / 100000) + ((1 / 5) * (Age - 40) *
((159 - 129) / 100000))
If Age >= 45 Then INCIDENCE(Age) = (159 / 100000) + ((1 / 5) * (Age - 45) *
((220 - 159) / 100000))
If Age >= 50 Then INCIDENCE(Age) = (220 / 100000) + ((1 / 5) * (Age - 50) *
((261 - 220) / 100000))
If Age >= 55 Then INCIDENCE(Age) = (261 / 100000) + ((1 / 5) * (Age - 55) *
((330 - 261) / 100000))
If Age >= 60 Then INCIDENCE(Age) = (330 / 100000) + ((1 / 5) * (Age - 60) *
((390 - 330) / 100000))
If Age >= 65 Then INCIDENCE(Age) = (390 / 100000) + ((1 / 5) * (Age - 65) *
((421 - 390) / 100000))
If Age >= 70 Then INCIDENCE(Age) = (421 / 100000) + ((1 / 5) * (Age - 70) *
((461 - 421) / 100000))

```

```
If Age >= 75 Then INCIDENCE(Age) = (461 / 100000) + ((1 / 5) * (Age - 75) *
((461 - 421) / 100000))
```

```
' YLL data from "National Vital Statistics Reports Vol 47 #28 December 13
1999"
```

```
' YLL = Years of Life Left
```

```
If Age >= 20 Then YLL(Age) = 60.2 - ((1 / 5) * (Age - 20) * ((60.2 - 55.4)))
If Age >= 25 Then YLL(Age) = 55.4 - ((1 / 5) * (Age - 25) * ((55.4 - 50.5)))
If Age >= 30 Then YLL(Age) = 50.5 - ((1 / 5) * (Age - 30) * ((50.5 - 45.7)))
If Age >= 35 Then YLL(Age) = 45.7 - ((1 / 5) * (Age - 35) * ((45.7 - 40.9)))
If Age >= 40 Then YLL(Age) = 40.9 - ((1 / 5) * (Age - 40) * ((40.9 - 36.6)))
If Age >= 45 Then YLL(Age) = 36.3 - ((1 / 5) * (Age - 45) * ((36.6 - 31.7)))
If Age >= 50 Then YLL(Age) = 31.7 - ((1 / 5) * (Age - 50) * ((31.7 - 27.3)))
If Age >= 55 Then YLL(Age) = 27.3 - ((1 / 5) * (Age - 55) * ((27.3 - 23.1)))
If Age >= 60 Then YLL(Age) = 23.1 - ((1 / 5) * (Age - 60) * ((23.1 - 19.2)))
If Age >= 65 Then YLL(Age) = 19.2 - ((1 / 5) * (Age - 65) * ((19.2 - 15.5)))
If Age >= 70 Then YLL(Age) = 15.5 - ((1 / 5) * (Age - 70) * ((15.5 - 12.1)))
If Age >= 75 Then YLL(Age) = 12.1 - ((1 / 5) * (Age - 75) * ((12.1 - 9.1)))
If Age >= 80 Then YLL(Age) = 9.1 - ((1 / 5) * (Age - 80) * ((9.1 - 6.6)))
If Age >= 85 Then YLL(Age) = 6.6 - ((1 / 5) * (Age - 85) * ((6.6 - 4.7)))
If Age >= 90 Then YLL(Age) = 4.7 - ((1 / 5) * (Age - 90) * ((4.7 - 3.4)))
If Age >= 95 Then YLL(Age) = 3.4 - ((1 / 5) * (Age - 95) * ((3.4 - 2.5)))
```

```
' "AGEfraction" data from "Statistical Abstracts of the United Staes 1998":
values over 85 are rough guesstimates
```

```
If Age >= 20 Then AGEfraction(Age) = 0.062 / 5
If Age >= 25 Then AGEfraction(Age) = 0.069 / 5
If Age >= 30 Then AGEfraction(Age) = 0.076 / 5
If Age >= 35 Then AGEfraction(Age) = 0.083 / 5
If Age >= 40 Then AGEfraction(Age) = 0.079 / 5
If Age >= 45 Then AGEfraction(Age) = 0.069 / 5
If Age >= 50 Then AGEfraction(Age) = 0.057 / 5
If Age >= 55 Then AGEfraction(Age) = 0.045 / 5
If Age >= 60 Then AGEfraction(Age) = 0.039 / 5
If Age >= 65 Then AGEfraction(Age) = 0.075 / 10
If Age >= 70 Then AGEfraction(Age) = 0.075 / 10
If Age >= 75 Then AGEfraction(Age) = 0.052 / 10
If Age >= 80 Then AGEfraction(Age) = 0.052 / 10
If Age >= 85 Then AGEfraction(Age) = 0.001 / 10
If Age >= 90 Then AGEfraction(Age) = 0.001 / 10
If Age >= 95 Then AGEfraction(Age) = 0.0001 / 10
```

```
Next Age
```

```
' Now, we 'll create a way to adjust the values for the population as a whole
for the
```

```
' age structure (ie AGEfraction above) of the population
```

```
AgeFractionDENOMINATOR = 0
```

```
For Age = MinAGE To MaxAGE Step 1
```

```
AgeFractionDENOMINATOR = AgeFractionDENOMINATOR + AGEfraction(Age)
```

```
Next Age
```

```
'
```

```
For Age = MinAGE To MaxAGE Step 1
```

```
AgeStructureAdjustemnt(Age) = ((AGEfraction(Age) / AgeFractionDENOMINATOR) _
/ (1 / (MaxAGE - MinAGE)))
```

```
Next Age
```

```
'The following variables describe the death rate, and reduction in death rate,
for all the whole population of women,
' by screening interval and age [(3651, 90)]
Dim DEATHFRACTION(3651, 90) As Single
Dim DEATHREDUCTION(3651, 90) As Single
```

```
'below , we 'll use these to calculate how much death would occur without
mammography
Dim tempMAXDEATH(5, 5) As Single
Dim MAXDEATH(90) As Single
```

```
'Since we'll be treating the breast cancers within a population of women as
the sum of a
' variety of slightly different tumors
' [specifically differing at the size at which they'll be detected by
mammography (Sm) and by palpation (Sp)],
' we'll need temporary values (tempDEATHFRACTION and tempDEATHREDUCTION), from
which to later make
' the overall estimate of DEATHFRACTION and DEATHREDUCTION for the whole
population by
' summing tempDEATHFRACTION and tempDEATHREDUCTION.
```

```
Dim tempDEATHFRACTION(7, 7, 3651) As Single
Dim tempDEATHREDUCTION(7, 7, 3651) As Single
```

```
' The following variable are used to calculate cost and marginal cost.
Dim AVERAGECOST(3651, 90) As Single
Dim MARGINALCOST(3651, 90) As Single
```

```
'the following are for making tables of marginal cost etc
Dim INTERVALforEACHmarginalAMOUNT(2200, 90) As Variant
Dim CorrespondingReduction(2200, 90) As Single
Dim PopulationWideCorrespondingReduction(2200) As Single
Dim UnAgeAdjustedPopulationWideCorrespondingReduction(2200) As Single
Dim AVERAGEPopulationWideCorrespondingReduction(2200) As Single
```

```
'by defining the next variable, we can keep track of what the marginal cost
("ammount")
' is for each each line that we will make in a table of marginal amounts
' above 2000, we'll use it to keep track of various types of screening
recomendations
Dim amountFOReachAmountMarker(2200) As Single
```

```
'HERE'S THE BODY OF THE BREAST CANCER GROWTH/SPREAD SIMULATION:
' IT GOES DOWN TO ABOUT LINE 310
```

```
' (note, below we'll be examining woman of various ages.
```

```
For Age = MinAGE To MaxAGE
```

```
' next we shall consider each of the various levels of mammographic and
palpable
' detectability, by considering that there are a variety of classes of
tumors differing
```



```

' with respect to the minimal sizes detectable by mammography (Sm) and
palpation(Sp).
For SmClass = 1 To 5
For SpClass = 1 To 5

' note:
' for women as a whole, the median (SmClass 3) ~ .7, modifier = 1

' FIRST OPTION : IF WE DON'T KNOW DENSITY, LET AGE SET the value of "Sm"
' for women less than 50, the median (SmClass 3) ~ .95, modifier =
1.357
' for women more than 50, the median (SmClass 3) ~ .7, modifier = 1
' assuming linear extrapolation:
'
modifier = 2.16025 - (Age * 0.01785)

' SECOND OPTION : IF WE DO KNOW DENSITY
' for women of density 1,2,3, the median (SmClass 3) ~ .60, modifier =
.857
' for women of density 4 the median (SmClass 3) ~ 1.0, modifier =
1.43
' for women of density 5,6,7 the median (SmClass 3) ~ 1.2, modifier = 2
' so:
' if density =123 then modifier = 0.857
' if density =4 then modifier = 1.43
' if density =567 then modifier = 2

If SmClass = 1 Then SmDiameter = 0.35 * modifier
If SmClass = 2 Then SmDiameter = 0.55 * modifier
If SmClass = 3 Then SmDiameter = 0.7 * modifier
If SmClass = 4 Then SmDiameter = 0.925 * modifier
If SmClass = 5 Then SmDiameter = 1.17 * modifier

' estimate from MGH
'If SpClass = 1 Then SpDiameter = 0.8
'If SpClass = 2 Then SpDiameter = 1.2
'If SpClass = 3 Then SpDiameter = 1.7
'If SpClass = 4 Then SpDiameter = 2.2
'If SpClass = 5 Then SpDiameter = 5.9

' rough guesstimate from Tabar (ADJUSTED to give a median value of 2 cm)
If SpClass = 1 Then SpDiameter = 0.8 * 1.176
If SpClass = 2 Then SpDiameter = 1.2 * 1.176
If SpClass = 3 Then SpDiameter = 1.7 * 1.176
If SpClass = 4 Then SpDiameter = 2.2 * 1.176
If SpClass = 5 Then SpDiameter = 5.9 * 1.176

'@ the following line can be used to examine not screening below a certain age
' If Age < 40 Then SmDiameter = SpDiameter + 0.000001

'"screenlimit" is the minimal tumor size detectable by a mammogram.
screenlimit = (4 / 3) * 3.14 * (SmDiameter / 2) ^ 3 * 100000000#

'"naturallimit" is the minimal tumor size detectable by palpation.

```

```

naturallimit = (4 / 3) * 3.14 * (SpDiameter / 2) ^ 3 * 100000000#

' tempMAXDEATH (SmClass, SpClass) is the amount of death that would occur in
' the absence of screening.
Nx = ((4 / 3) * 3.14 * (SpDiameter / 2) ^ 3) * 100000000#
Px = (Nx ^ (0.4425 - 1)) * 0.00005017
tempMAXDEATH(SmClass, SpClass) = 1 - (1 / (Exp((Nx * Px))))

'"If_Im_1_thenMammo_Saw_CA" is used as a sign that the tumor is detectable by
' mammography.
' "If_Im_1_thenMammo_Saw_CA" starts out as =0, but when the screenlimit
' has been reached, {i.e when the cell number (n) comes to exceed the
screenlimit,}
' (after line 220), "If_Im_1_thenMammo_Saw_CA" is reset to
"If_Im_1_thenMammo_Saw_CA=0".
' Every time the program goes to examine women of a different age, it gets
set on
' the next line back to "If_Im_1_thenMammo_Saw_CA=0.
If_Im_1_thenMammo_Saw_CA = 0

'"Today" will be used as a reset-able day-counter, to be reset twice:
' 1)-Today gets reset on line 110, at the time when the tumor first
starts to
' grow from 1 cell (n=1 line 120)
' and
' 2)-Today gets reset to 1 (after line 220), after the tumor first
becomes detectable by
' mammography, that is, when the screenlimit (Sm) is reached.
110 Today = 1

' n is the number of cells in the tumor; obviously it starts with one cell
(n=1).
' However, at some very slow growth rates, growth never gets beyond a single
cell,
' so, from a practical standpoint, we shall start at n=100
' (This has a negligible effect on the probability of spread estimates)

' Growth occurs just below line 301.
' ##### march 30 changed below to higher number to shorten runtime
120 N = Int(screenlimit) - 100

' "prob" is the probability of the tumor as a whole forming one or more
distant
' metastases; it is derived from the Poisson distribution, prob = 1 - (1 /
(Exp((n * p)))), line 227 below
' "LastCumprob" is used to estimate below how much additional
' benefit is gained with the loss of each additional day between exams,
' i.e. in the calculation of the marginal cost of screening, (LastCumprob =
cumprob), line 302 below
' Below, we'll need to reset the these two values each time we examine women
' of a different group.
cumprob = 0
prob = 0

'the breast cancer doubling time is from our analysis of screening data.

```

```

' "g" is the growth fraction, that is, the fraction of cells that must
' be dividing to achieve such a tumor doubling time (which was set above),
' assuming a cell cycle time of 24 hours.  g = ln(2)/ doublingtime

' below is the estimate of tumor growth from duffy/Tabar
'doublingtime = (6.954 * Age) - 106.19
' below is the calculation of g, the fraction of cells dividing
g = (2 ^ (1 / doublingtime)) - 1

'In the next two lines, we'll be checking whether the tumor has reached
' mammographically detectable size (the "screenlimit"), and modifying the
simulation
' to determine the consequences of this event.
220 If If_Im_1_thenMammo_Saw_CA = 1 Then GoTo 221
If N > screenlimit Then If_Im_1_thenMammo_Saw_CA = 1: Today = 0: cumprob = 0
221 Today = Today + 1
' If Today > 3650 And If_Im_1_thenMammo_Saw_CA = 1 Then GoTo 410
If Today > 3650 Then GoTo 410

301 If prob = 1 Or N > naturallimit Then GoTo 302

' next is the equation that makes the tumor grow.
223 N = N + (g * N)

' "p" is the probability of each cell in the tumor forming a distant
metastasis.
225 p = (N ^ (0.4425 - 1)) * 0.00005017
' GRIFFIN'S QUOTE BELOW
'and where you divided by ((10000000000#) ^ 0.4841), which occurs both in the
calculation
'of "p" and in the tempMAXDEATH calculation, I now multiply by 1.424E-5.
'Note that 1/1E10^0.4841 = 1.442E-5. So, your approximation actually was very
close.

' again, "prob" is the probability of the tumor as a whole forming one or more
distant
' metastases; it is derived from the Poisson distribution.
227 prob = 1 - (1 / (Exp((N * p))))

' next, we're going to need "LastCumprob" , which, as we noted above, is used
to estimate below how
' much additional benefit is gained with the loss of each additional day
between exams,
' i.e. in the calculation of the marginal cost of screening.
302 LastCumprob = cumprob

'"cumprob" is the PROBABILITY of distant metastasis in the SUM all women who
' are examined. Randomness in the time when these tumors arise means that
' the tumor in a woman is equally likely to have reached mammographically
' detectable size the day after her last negative exam as on the day before
' her following positive exam, or any day in between. Thus, cumprob is the
' SUM of all probabilities of spread ("probs") from the day after that
negative
' exam, to today, (i.e. the "Today"). Note, in our calculations below, we'll
need

```

```

' to divide "cumprob" by the "Today" to get the average probability of all
women in
' such a group.
cumprob = cumprob + prob

'Since no detection can occur when tumors are smaller than the screenlimit,
' (i.e. If_Im_1_thenMammo_Saw_CA has been made to be
If_Im_1_thenMammo_Saw_CA=0), we'll
' run up the tumor size by returning to the growth step till the screenlimit
is reached.
'If, however, the screenlimit has been reached (i.e. if n>screenlimit),
' thus making If_Im_1_thenMammo_Saw_CA= 1, below line 22 above), then the
program can pass on from
' here to put these results into an array, and then do further work.
310 If If_Im_1_thenMammo_Saw_CA = 0 Then GoTo 220

tempDEATHFRACTION(SmClass, SpClass, Today) = (cumprob / Today)

tempDEATHREDUCTION(SmClass, SpClass, Today) = 1 - ((cumprob / Today) /
tempMAXDEATH(SmClass, SpClass))

'In the following loop, we shall make our daily return to the point where the
' cell number increases:
GoTo 220

410
Next SpClass
Next SmClass

' below, before finishing the age loop by going to the next age in line 411,
we'll do
' a couple of small loops to calculate MAXDEATH, DEATHFRACTION, and
DEATHREDUCTION
For SpClass = 1 To 5
For SmClass = 1 To 5
MAXDEATH(Age) = MAXDEATH(Age) + (tempMAXDEATH(SmClass, SpClass) * (1 / 25))
Next SmClass
Next SpClass

For Today = 1 To 3650
For SpClass = 1 To 5
For SmClass = 1 To 5
DEATHFRACTION(Today, Age) =
DEATHFRACTION(Today, Age) + (tempDEATHFRACTION(SmClass, SpClass, Today) * (1 /
25))
Next SmClass
Next SpClass
DEATHREDUCTION(Today, Age) = 1 - (DEATHFRACTION(Today, Age) / MAXDEATH(Age))
Next Today

411 Next Age

' next, we'll calculate the total costs per year of life saved, & place it into
an array
' AVERAGECOST = [testcost * (365/Today)] / (INCIDENCE)*
(DEATHREDUCTION)*(YLL)

```

```

For Age = MinAGE To MaxAGE
For Today = 1 To 3650
AVERAGECOST(Today, Age) = (testcost) * (365 / Today) / _
((INCIDENCE(Age)) * MAXDEATH(Age) * (DEATHREDUCTION(Today, Age)) * YLL(Age))
Next Today
Next Age

' Next we'll calculate the marginal cost
'NOTE: we do NOT calculate MARGINALCOST for Today=1
For Age = MinAGE To MaxAGE Step 1
For Today = 2 To 3650

' @ "If (DEATHREDUCTION(Today - 1, Age) <> DEATHREDUCTION(Today, Age)) Then"
added below
If (DEATHREDUCTION(Today - 1, Age) <> DEATHREDUCTION(Today, Age)) Then
MARGINALCOST(Today, Age) = (testcost) * ((365 / (Today - 1)) - (365 / Today))
/ _
(((DEATHREDUCTION(Today - 1, Age)) - DEATHREDUCTION(Today, Age)) *
MAXDEATH(Age) * _
(INCIDENCE(Age)) * YLL(Age))

Next Today
Next Age

'next, we'll set the marginal costs that we will list in our array,& place in
the file:
'      $0 to $10,000 by 400 $25 intervals then
'      $10,000 to $100,000 by 360 $250 intervals then
'      $100,000 to $1,00,00 by 360 $2500 intervals
'      $100,0000 to $29,00,000 by 1120 $2500 intervals
For AmountMarker = 1 To 2000
If amount < 9999 Then amount = amount + 25
If amount >= 9999 And amount < 99999 Then amount = amount + 250
If amount >= 99999 And amount < 999999 Then amount = amount + 2500
If amount >= 999999 And amount Then amount = amount + 25000
' below, we 'll use "(amountFOReachAmountMarker(AmountMarker))" to index the
lines
'      in our table of marginal costs
amountFOReachAmountMarker(AmountMarker) = amount
Next AmountMarker

'NOW we'll construct the table of marginal cost vs. interval (by age)
450 For Age = MinAGE To MaxAGE
500 For AmountMarker = 1 To 2000
510 Today = 3650
511 Today = Today - 1
If Today <= 0 Then GoTo 520
If MARGINALCOST(Today, Age) < amountFOReachAmountMarker(AmountMarker) Then
GoTo 511
If MARGINALCOST(Today, Age) > amountFOReachAmountMarker(AmountMarker) Then:
    If Today >= (3650 - 1) Then INTERVALforEACHmarginalAMOUNT((AmountMarker),
Age) = "none"
    If Today < (3650 - 1) Then INTERVALforEACHmarginalAMOUNT((AmountMarker),
Age) = Today / 30

```

```

    If Today >= (3650 - 1) Then CorrespondingReduction((AmountMarker), Age) =
0
    If Today < (3650 - 1) Then CorrespondingReduction((AmountMarker), Age) =
DEATHREDUCTION(Today, Age)
        GoTo 520
520 Next AmountMarker
Next Age

```

'now,we'll calculate the corresponding reduction in death, and overall avreage costs,

' for each marginal cost.

DENOMINATOR = 0

For Age = MinAGE To MaxAGE Step 1

DENOMINATOR = DENOMINATOR + INCIDENCE(Age)

Next Age

'

For AmountMarker = 1 To 2000

For Age = MinAGE To MaxAGE Step 1

' estimate of the total number of mammograms within the populations

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = "none" Then

INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = 0

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) > 0 Then \_

MammoTotal(AmountMarker) = MammoTotal(AmountMarker) + \_  
((365 / 30) \* (1 / (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age))))

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) > 0 Then \_  
AgeAdjustedMammoTotal(AmountMarker) = AgeAdjustedMammoTotal(AmountMarker) + \_  
((365 / 30) \* ((1 / (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age))) \* \_  
AgeStructureAdjustemnt(Age)))

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = 0 Then

INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = "none"

' (4)

PopulationWideCorrespondingReduction(AmountMarker) = \_  
(PopulationWideCorrespondingReduction(AmountMarker)) + \_  
(AgeStructureAdjustemnt(Age) \* \_  
((CorrespondingReduction(AmountMarker, Age) \* \_  
INCIDENCE(Age) / DENOMINATOR))

' (1)

UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) = \_  
(UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)) + \_  
((CorrespondingReduction(AmountMarker, Age) \* INCIDENCE(Age) / DENOMINATOR))

' (5)

AVERAGEPopulationWideCorrespondingReduction(AmountMarker) = \_  
(AVERAGEPopulationWideCorrespondingReduction(AmountMarker)) + \_  
((CorrespondingReduction(AmountMarker, Age)) / (MaxAGE - MinAGE))

' below, we' calculate "UnAgeAdustedOverallAVERAGECOST", the average cost for a group of

' 65 women, each of a different age, from age 20 to age 85, for each marginal cost.

' and the "USAAgeAdustedOverallAVERAGECOST", the average cost for a population of  
 ' women with the age structure of the USA, for each marginal cost (AmountMarker)

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = "none" Then  
 INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = 0  
 x = CInt((INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) \* 30))

If Age = MinAGE Then zeta = 0  
 If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) > 0 Then zeta = zeta + 1  
 If Age = MaxAGE And zeta = 0 Then zeta = 1

' (6)  
 UnAgeAdustedOverallAVERAGECOST(AmountMarker) =  $\frac{\text{UnAgeAdustedOverallAVERAGECOST(AmountMarker)}}{\text{AVERAGECOST}(x, \text{Age})}$   
 UnAgeAdustedOverallAVERAGECOST(AmountMarker) +  $\frac{\text{UnAgeAdustedOverallAVERAGECOST(AmountMarker)}}{\text{AVERAGECOST}(x, \text{Age})}$   
 AVERAGECOST(x, Age)  
 If Age = MaxAGE Then UnAgeAdustedOverallAVERAGECOST(AmountMarker) =  $\frac{\text{UnAgeAdustedOverallAVERAGECOST(AmountMarker)}}{\text{zeta}}$

' (7)  
 USAAgeAdustedOverallAVERAGECOST(AmountMarker) =  $\frac{\text{USAAgeAdustedOverallAVERAGECOST(AmountMarker)}}{\text{AVERAGECOST}(x, \text{Age}) * \text{AgeStructureAdjustemnt}(\text{Age})}$   
 USAAgeAdustedOverallAVERAGECOST(AmountMarker) +  $\frac{\text{USAAgeAdustedOverallAVERAGECOST(AmountMarker)}}{\text{AVERAGECOST}(x, \text{Age}) * \text{AgeStructureAdjustemnt}(\text{Age})}$   
 (AVERAGECOST(x, Age) \* AgeStructureAdjustemnt(Age))  
 If Age = MaxAGE Then USAAgeAdustedOverallAVERAGECOST(AmountMarker) =  $\frac{\text{USAAgeAdustedOverallAVERAGECOST(AmountMarker)}}{\text{zeta}}$

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = 0 Then  $\frac{\text{INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)}}{\text{INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)}} = \text{"none"}$

Next Age  
 Next AmountMarker

'now, we'll calculate the corresponding Population wide savings in years of life saved.

For AmountMarker = 1 To 2000  
 For Age = MinAGE To MaxAGE Step 1  
 ' (2)  
 PopulationWideYLS(AmountMarker) =  $\frac{\text{PopulationWideYLS(AmountMarker)}}{\text{AgeStructureAdjustemnt}(\text{Age}) * (\text{CorrespondingReduction(AmountMarker, Age)} * (\text{INCIDENCE(Age)} * \text{MAXDEATH(Age)} * (\text{YLL(Age)}))}$   
 (PopulationWideYLS(AmountMarker)) +  $\frac{\text{PopulationWideYLS(AmountMarker)}}{\text{AgeStructureAdjustemnt}(\text{Age}) * (\text{CorrespondingReduction(AmountMarker, Age)} * (\text{INCIDENCE(Age)} * \text{MAXDEATH(Age)} * (\text{YLL(Age)}))}$   
 (AgeStructureAdjustemnt(Age) \*  $\frac{\text{PopulationWideYLS(AmountMarker)}}{\text{AgeStructureAdjustemnt}(\text{Age}) * (\text{CorrespondingReduction(AmountMarker, Age)} * (\text{INCIDENCE(Age)} * \text{MAXDEATH(Age)} * (\text{YLL(Age)}))}$   
 (CorrespondingReduction(AmountMarker, Age)) \* (INCIDENCE(Age)) \* MAXDEATH(Age) \* (YLL(Age)))  
 Next Age  
 Next AmountMarker

'now, we'll calculate the savings in years of life saved, for women with cancer.

DENOMINATOR = 0  
 For Age = MinAGE To MaxAGE Step 1  
 DENOMINATOR = DENOMINATOR + INCIDENCE(Age)  
 Next Age

For AmountMarker = 1 To 2000  
 For Age = MinAGE To MaxAGE Step 1  
 ' (3)

```

CancerPatientsYLS(AmountMarker) = _
(CancerPatientsYLS(AmountMarker)) + _
(AgeStructureAdjustemnt(Age) * _
(((CorrespondingReduction(AmountMarker, Age)) * (YLL(Age)) _
* (INCIDENCE(Age))) * MAXDEATH(Age) / (DENOMINATOR)))

```

```

Next Age
Next AmountMarker

```

'NOW, the LAST thing we'll do before we put the data into files (line999) is to calculate the consequences of other patterns of screening, such as the ACS recomendation, UK pattern, etc.

```

Pattern = 2001
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 And Age <= 65 Then IndicatedInterval(Pattern, Age) = (30 * 36)
If Age > 65 Then IndicatedInterval(Pattern, Age) = 0
Next Age
PatternName(Pattern) = "UK"

```

```

Pattern = 2002
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = CInt((365 * 1.4))
Next Age
PatternName(Pattern) = "MGH TYPICAL"

```

```

Pattern = 2003
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = 360
Next Age
PatternName(Pattern) = "ACS Recomendend"

```

```

Pattern = 2004
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = CInt((365))
Next Age
PatternName(Pattern) = "NCI"

```

```

Pattern = 2005
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 And Age <= 69 Then IndicatedInterval(Pattern, Age) = (365)
If Age > 70 Then IndicatedInterval(Pattern, Age) = 0
Next Age
PatternName(Pattern) = "KERLIKOWSI"

```

```

Pattern = 2006
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 And Age <= 49 Then IndicatedInterval(Pattern, Age) = (30 * 24)
If Age >= 50 And Age <= 74 Then IndicatedInterval(Pattern, Age) = (30 * 33)

```



```
If Age > 75 Then IndicatedInterval(Pattern, Age) = 0
Next Age
PatternName(Pattern) = "SWEEDISH 2 COUNTY"
```

```
Pattern = 2007
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (364 / 2)
Next Age
PatternName(Pattern) = "6 month"
```

```
Pattern = 2008
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 And Age <= 54 Then IndicatedInterval(Pattern, Age) = (365 * 1.5)
If Age > 54 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "Tabar Proposal"
```

```
Pattern = 2009
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = 360
If Age > 70 Then IndicatedInterval(Pattern, Age) = 0
Next Age
PatternName(Pattern) = "ACS Recomendaded, STOPPING AT 70"
```

```
Pattern = 2010
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 30"
```

```
Pattern = 2011
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 35"
```

```
Pattern = 2012
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 40"
```

```
Pattern = 2013
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 45"
```

```
Pattern = 2014
```

```
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 50"
```

```
Pattern = 2015
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 3)
Next Age
PatternName(Pattern) = "4 month from age 30"
```

```
Pattern = 2016
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / 3)
Next Age
PatternName(Pattern) = "4 month from age 35"
```

```
Pattern = 2017
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / 3)
Next Age
PatternName(Pattern) = "4 month from age 40"
```

```
Pattern = 2018
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / 3)
Next Age
PatternName(Pattern) = "4 month from age 45"
```

```
Pattern = 2019
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / 3)
Next Age
PatternName(Pattern) = "4 month from age 50"
```

```
Pattern = 2020
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 5))
Next Age
PatternName(Pattern) = "5 month from age 30"
```

```
Pattern = 2021
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 5))
Next Age
PatternName(Pattern) = "5 month from age 35"
```

```

Pattern = 2022
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 5))
Next Age
PatternName(Pattern) = "5 month from age 40"

Pattern = 2023
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 5))
Next Age
PatternName(Pattern) = "5 month from age 45"

Pattern = 2024
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 5))
Next Age
PatternName(Pattern) = "5 month from age 50"

'=====
Pattern = 2025
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 30"

Pattern = 2026
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 35"

Pattern = 2027
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 40"

Pattern = 2028
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 45"

Pattern = 2029
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 50"

```

```
Pattern = 2030
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 30"
```

```
Pattern = 2031
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 35"
```

```
Pattern = 2032
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 40"
```

```
Pattern = 2033
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 45"
```

```
Pattern = 2034
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 50"
```

```
Pattern = 2035
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
PatternName(Pattern) = "12 month from age 30"
```

```
Pattern = 2036
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
PatternName(Pattern) = "12 month from age 35"
```

```
Pattern = 2037
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
```

```

PatternName(Pattern) = "12 month from age 40"

Pattern = 2038
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
PatternName(Pattern) = "12 month from age 45"

Pattern = 2039
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
PatternName(Pattern) = "12 month from age 50"

Pattern = 2040
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (2 / 3))
Next Age
PatternName(Pattern) = "18 month from age 30"

Pattern = 2041
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / (2 / 3))
Next Age
PatternName(Pattern) = "18 month from age 35"

Pattern = 2042
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / (2 / 3))
Next Age
PatternName(Pattern) = "18 month from age 40"

Pattern = 2043
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / (2 / 3))
Next Age
PatternName(Pattern) = "18 month from age 45"

Pattern = 2044
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / (2 / 3))
Next Age
PatternName(Pattern) = "18 month from age 50"

Pattern = 2045
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 * 2)

```

```

Next Age
PatternName(Pattern) = "24 month from age 30"

Pattern = 2046
For Age = MinAGE To MaxAGE Step 1
If Age < 35 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 35"

Pattern = 2047
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 40"

Pattern = 2048
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 45"

Pattern = 2049
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 50"

Pattern = 2050
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 20"

Pattern = 2051
For Age = MinAGE To MaxAGE Step 1
If Age < 21 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 21 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 21"

Pattern = 2052
For Age = MinAGE To MaxAGE Step 1
If Age < 22 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 22 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 22"

Pattern = 2053
For Age = MinAGE To MaxAGE Step 1
If Age < 23 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 23 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age

```

PatternName(Pattern) = "6 month from age 23"

Pattern = 2054

For Age = MinAGE To MaxAGE Step 1

If Age < 24 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 24 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 24"

Pattern = 2055

For Age = MinAGE To MaxAGE Step 1

If Age < 25 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 25"

Pattern = 2056

For Age = MinAGE To MaxAGE Step 1

If Age < 26 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 26 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 26"

Pattern = 2057

For Age = MinAGE To MaxAGE Step 1

If Age < 27 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 27 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 27"

Pattern = 2058

For Age = MinAGE To MaxAGE Step 1

If Age < 28 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 28 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 28"

Pattern = 2059

For Age = MinAGE To MaxAGE Step 1

If Age < 29 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 29 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 29"

Pattern = 2060

For Age = MinAGE To MaxAGE Step 1

If Age < 30 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 30"

Pattern = 2061

For Age = MinAGE To MaxAGE Step 1

If Age < 31 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 31 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 31"

Pattern = 2062

For Age = MinAGE To MaxAGE Step 1

If Age < 32 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 32 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 32"

Pattern = 2063

For Age = MinAGE To MaxAGE Step 1

If Age < 33 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 33 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 33"

Pattern = 2064

For Age = MinAGE To MaxAGE Step 1

If Age < 34 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 34 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 34"

Pattern = 2065

For Age = MinAGE To MaxAGE Step 1

If Age < 35 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 35 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 35"

Pattern = 2066

For Age = MinAGE To MaxAGE Step 1

If Age < 36 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 36 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 36"

Pattern = 2067

For Age = MinAGE To MaxAGE Step 1

If Age < 37 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 37 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 37"

Pattern = 2068

For Age = MinAGE To MaxAGE Step 1

If Age < 38 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 38 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age

PatternName(Pattern) = "6 month from age 38"

Pattern = 2069

For Age = MinAGE To MaxAGE Step 1

If Age < 39 Then IndicatedInterval(Pattern, Age) = 0

If Age >= 39 Then IndicatedInterval(Pattern, Age) = (365 / 2)

Next Age



```
PatternName(Pattern) = "6 month from age 39"

Pattern = 2070
For Age = MinAGE To MaxAGE Step 1
If Age < 40 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 40 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 40"

Pattern = 2071
For Age = MinAGE To MaxAGE Step 1
If Age < 41 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 41 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 41"

Pattern = 2072
For Age = MinAGE To MaxAGE Step 1
If Age < 42 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 42 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 42"

Pattern = 2073
For Age = MinAGE To MaxAGE Step 1
If Age < 43 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 43 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 43"

Pattern = 2074
For Age = MinAGE To MaxAGE Step 1
If Age < 44 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 44 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 44"

Pattern = 2075
For Age = MinAGE To MaxAGE Step 1
If Age < 45 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 45 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 45"

Pattern = 2076
For Age = MinAGE To MaxAGE Step 1
If Age < 46 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 46 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 46"

Pattern = 2077
For Age = MinAGE To MaxAGE Step 1
If Age < 47 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 47 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
```

```

PatternName(Pattern) = "6 month from age 47"

Pattern = 2078
For Age = MinAGE To MaxAGE Step 1
If Age < 48 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 48 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 48"

Pattern = 2079
For Age = MinAGE To MaxAGE Step 1
If Age < 49 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 49 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 49"

Pattern = 2080
For Age = MinAGE To MaxAGE Step 1
If Age < 50 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 50 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 50"

Pattern = 2081
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 30"

Pattern = 2082
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 3)
Next Age
PatternName(Pattern) = "4 month from age 30"

Pattern = 2083
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 5))
Next Age
PatternName(Pattern) = "5 month from age 30"

Pattern = 2084
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 30"

Pattern = 2085
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 7))
Next Age
PatternName(Pattern) = "7 month from age 30"

```

```

Pattern = 2086
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 8))
Next Age
PatternName(Pattern) = "8 month from age 30"

Pattern = 2087
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 9))
Next Age
PatternName(Pattern) = "9 month from age 30"

Pattern = 2088
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 10))
Next Age
PatternName(Pattern) = "10 month from age 30"

Pattern = 2089
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 11))
Next Age
PatternName(Pattern) = "11 month from age 30"

Pattern = 2090
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
PatternName(Pattern) = "12 month from age 30"

Pattern = 2091
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 * 1.5)
Next Age
PatternName(Pattern) = "18 month from age 30"

Pattern = 2092
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 30"

Pattern = 2093
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 * 2.5)
Next Age
PatternName(Pattern) = "30 month from age 30"

```

```

Pattern = 2094
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 * 3)
Next Age
PatternName(Pattern) = "36 month from age 30"

Pattern = 2095
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (24 / 1))
Next Age
PatternName(Pattern) = "1/2 month from age 30"

Pattern = 2096
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 1))
Next Age
PatternName(Pattern) = "1 month from age 30"

Pattern = 2097
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 2))
Next Age
PatternName(Pattern) = "2 month from age 30"

Pattern = 2098
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 / (12 / 3))
Next Age
PatternName(Pattern) = "3 month from age 30"

Pattern = 2199
For Age = MinAGE To MaxAGE Step 1
If Age < 30 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 30 Then IndicatedInterval(Pattern, Age) = (365 * 4)
Next Age
PatternName(Pattern) = "48 month from age 30"

Pattern = 2100
'spacer

Pattern = 2101
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 20"

Pattern = 2102
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 / 2)

```

```

Next Age
PatternName(Pattern) = "6 month from age 20"

Pattern = 2103
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 20"

Pattern = 2104
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 / 1)
Next Age
PatternName(Pattern) = "12 month from age 20"

Pattern = 2105
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 * 1.5)
Next Age
PatternName(Pattern) = "18 month from age 20"

Pattern = 2106
For Age = MinAGE To MaxAGE Step 1
If Age < 20 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 20 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 20"

Pattern = 2107
For Age = MinAGE To MaxAGE Step 1
If Age < 25 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 / 4)
Next Age
PatternName(Pattern) = "3 month from age 25"

Pattern = 2108
For Age = MinAGE To MaxAGE Step 1
If Age < 25 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 / 2)
Next Age
PatternName(Pattern) = "6 month from age 25"

Pattern = 2109
For Age = MinAGE To MaxAGE Step 1
If Age < 25 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 / (4 / 3))
Next Age
PatternName(Pattern) = "9 month from age 25"

Pattern = 2110
For Age = MinAGE To MaxAGE Step 1
If Age < 25 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 / 1)

```

```

Next Age
PatternName(Pattern) = "12 month from age 25"

Pattern = 2111
For Age = MinAGE To MaxAGE Step 1
If Age < 25 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 * 1.5)
Next Age
PatternName(Pattern) = "18 month from age 25"

Pattern = 2112
For Age = MinAGE To MaxAGE Step 1
If Age < 25 Then IndicatedInterval(Pattern, Age) = 0
If Age >= 25 Then IndicatedInterval(Pattern, Age) = (365 * 2)
Next Age
PatternName(Pattern) = "24 month from age 25"

'+++++
+++++
'now, we'll calculate the corresponding reduction in death, and overall
average costs,
'           for the Indicated Intervals.
DENOMINATOR = 0
For Age = MinAGE To MaxAGE Step 1
DENOMINATOR = DENOMINATOR + INCIDENCE(Age)
Next Age

For AmountMarker = 2001 To 2115
For Age = MinAGE To MaxAGE Step 1

' estimate of the total number of mammograms within the populations
'If (IndicatedInterval(AmountMarker, Age)) = "none" Then
IndicatedInterval(AmountMarker, Age) = 0
If (IndicatedInterval(AmountMarker, Age)) > 0 Then _
MammoTotal(AmountMarker) = MammoTotal(AmountMarker) + _
(1 / ((IndicatedInterval(AmountMarker, Age)) / 365))

If (IndicatedInterval(AmountMarker, Age)) > 0 Then _
AgeAdjustedMammoTotal(AmountMarker) = AgeAdjustedMammoTotal(AmountMarker) + _
((1 / (IndicatedInterval(AmountMarker, Age) / 365)) _
* AgeStructureAdjustemnt(Age))

'If (IndicatedInterval(AmountMarker, Age)) = 0 Then
IndicatedInterval(AmountMarker, Age) = "none"

'(4)
PopulationWideCorrespondingReduction(AmountMarker) = _
(PopulationWideCorrespondingReduction(AmountMarker)) + _
(AgeStructureAdjustemnt(Age) * _
((DEATHREDUCTION(IndicatedInterval(AmountMarker, Age), Age) _
* INCIDENCE(Age) / DENOMINATOR)))

'(1)
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) = _

```

```

((UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)) + _
(
DEATHREDUCTION(IndicatedInterval(AmountMarker, Age), Age) _
* INCIDENCE(Age) / DENOMINATOR))

' (5)
AVERAGEPopulationWideCorrespondingReduction(AmountMarker) = _
(AVERAGEPopulationWideCorrespondingReduction(AmountMarker)) + _
((DEATHREDUCTION(IndicatedInterval(AmountMarker, Age), Age) / (MaxAGE -
MinAGE)))

' below, we' calculate "UnAgeAdustedOverallAVERAGECOST", the average cost for
a group of
' 65 women, each of a different age, from age 20 to age 85, for each
Indicated Interval.
' and the "USAAgeAdustedOverallAVERAGECOST", the average cost for a
population of
' women with the age structure of the USA, for each Indicated Interval
(AmountMarker)

If Age = MinAGE Then zeta2 = 0
' changed next line 12:30 sat nite
If IndicatedInterval(AmountMarker, Age) > 0 Then zeta2 = zeta2 + 1
If Age = MaxAGE And zeta2 = 0 Then zeta2 = 1

'If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = "none" Then
INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = 0
' (6)
UnAgeAdustedOverallAVERAGECOST(AmountMarker) = _
UnAgeAdustedOverallAVERAGECOST(AmountMarker) + _
AVERAGECOST(IndicatedInterval(AmountMarker, Age), Age)
If Age = MaxAGE Then UnAgeAdustedOverallAVERAGECOST(AmountMarker) = _
(UnAgeAdustedOverallAVERAGECOST(AmountMarker) / (zeta2))
' (7)
USAAgeAdustedOverallAVERAGECOST(AmountMarker) = _
USAAgeAdustedOverallAVERAGECOST(AmountMarker) + _
(AVERAGECOST(IndicatedInterval(AmountMarker, Age), Age) *
AgeStructureAdjustemnt(Age))

If Age = MaxAGE Then USAAgeAdustedOverallAVERAGECOST(AmountMarker) = _
(USAAgeAdustedOverallAVERAGECOST(AmountMarker) / (zeta2))

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = 0 Then _
INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = "none"

Next Age
Next AmountMarker

'now, we'll calculate the corresponding Population wide savings in years of
life saved.
For AmountMarker = 2001 To 2115
For Age = MinAGE To MaxAGE Step 1
' (2)
PopulationWideYLS(AmountMarker) = _
(PopulationWideYLS(AmountMarker)) + _
( _

```

```

AgeStructureAdjustemnt(Age) * _
DEATHREDUCTION(IndicatedInterval(AmountMarker, Age), Age) _
*
INCIDENCE(Age) * MAXDEATH(Age) * (YLL(Age)) _
)

```

```

Next Age
Next AmountMarker

```

'now, we'll calculate the savings in years of life saved, for women with cancer.

```

DENOMINATOR = 0
For Age = MinAGE To MaxAGE Step 1
DENOMINATOR = DENOMINATOR + INCIDENCE(Age)
Next Age

```

```

For AmountMarker = 2001 To 2115
For Age = MinAGE To MaxAGE Step 1
' (3)
CancerPatientsYLS(AmountMarker) = _
CancerPatientsYLS(AmountMarker) + _
(
AgeStructureAdjustemnt(Age) * _
DEATHREDUCTION(IndicatedInterval(AmountMarker, Age), Age) _
* YLL(Age) _
* INCIDENCE(Age) _
* MAXDEATH(Age) _
/ (DENOMINATOR) _
)

```

```

Next Age
Next AmountMarker

```

'We'll NOW put the data we've generated into files, so we can see them:

```

' First: we'll dump into a file the curves of:
' total amount of death ("DEATHFRACTION"), versus screening interval("Today")
' reduction in death ("DEATHREDUCTION ") versus screening interval("Today"),
' marginal cost ("MARGINALCOST") versus screening interval("Today"), and
' total cost versus screening interval("Today"), each graph by age
999 Open "c:\My Dump\JANv3a.txt" For Output As #2

```

```

Write #2, title
Write #2, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, , 20, 25,
30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, , 20, 25, 30, 35, 40, 45, 50,
55, 60, 65, 70, 75, 80, 85, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75,
80, 85, ,

```

```

For Today = 1 To 3650

```

'Add the "If then" part of the next statement to make graphs with smaller datasets



```

If Today / 30 = Int(Today / 30) Then Write #2, Today, DEATHFRACTION(Today,
20), DEATHFRACTION(Today, 25), DEATHFRACTION(Today, 30), DEATHFRACTION(Today,
35), DEATHFRACTION(Today, 40), DEATHFRACTION(Today, 45), DEATHFRACTION(Today,
50), DEATHFRACTION(Today, 55), DEATHFRACTION(Today, 60), DEATHFRACTION(Today,
65), DEATHFRACTION(Today, 70), DEATHFRACTION(Today, 75), DEATHFRACTION(Today,
80); DEATHFRACTION(Today, 85), _
Today, DEATHREDUCTION(Today, 20), DEATHREDUCTION(Today, 25),
DEATHREDUCTION(Today, 30), DEATHREDUCTION(Today, 35), DEATHREDUCTION(Today,
40), DEATHREDUCTION(Today, 45), DEATHREDUCTION(Today, 50),
DEATHREDUCTION(Today, 55), DEATHREDUCTION(Today, 60), DEATHREDUCTION(Today,
65), DEATHREDUCTION(Today, 70), DEATHREDUCTION(Today, 75),
DEATHREDUCTION(Today, 80), DEATHREDUCTION(Today, 85), Today,
MARGINALCOST(Today, 20), MARGINALCOST(Today, 25), MARGINALCOST(Today, 30),
MARGINALCOST(Today, 35), MARGINALCOST(Today, 40), MARGINALCOST(Today, 45),
MARGINALCOST(Today, 50), MARGINALCOST(Today, 55), MARGINALCOST(Today, 60),
MARGINALCOST(Today, 65), MARGINALCOST(Today, 70), MARGINALCOST(Today, 75),
MARGINALCOST(Today, 80), MARGINALCOST(Today, 85),
Today, AVERAGECOST(Today, 20), AVERAGECOST(Today, 25), AVERAGECOST(Today, 30),
AVERAGECOST(Today, 35), AVERAGECOST(Today, 40), AVERAGECOST(Today, 45),
AVERAGECOST(Today, 50), AVERAGECOST(Today, 55), AVERAGECOST(Today, 60),
AVERAGECOST(Today, 65), AVERAGECOST(Today, 70), AVERAGECOST(Today, 75),
AVERAGECOST(Today, 80), AVERAGECOST(Today, 85)

```

Next Today

Close #2

' Second: we'll dump the table of screening schedules into a second file:

Open "c:\My Dump\JANv3b.txt" For Output As #3

Write #3, title

Write #3, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, \_

"reduction in death", \_

"return/last test (days)", \_

"return/last test (hours)", \_

"marginal cost", \_

"death fraction", "survivors", \_

"CancerFreeYls", "CancerPatient's CancerFreeYLS", \_

"USA\_PopulationWideCorrespondingReduction", \_

"AVERAGEPopulationWideCorrespondingReduction", \_

"UnAgeAdustedOverallAVERAGECOST", \_

"USAAgeAdustedOverallAVERAGECOST", \_

"MammoTotal", \_

"AgeAjustedMammoTotal"

For AmountMarker = 1 To 2115

,

If amountFOReachAmountMarker(AmountMarker) = 0 Then Write #3,

INTERVALforEACHmarginalAMOUNT(AmountMarker, 20),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 25),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 30),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 35),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 40),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 45),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 50),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 55),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 60),

INTERVALforEACHmarginalAMOUNT(AmountMarker, 65),

```

INTERVALforEACHmarginalAMOUNT (AmountMarker, 70),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 75),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 80),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 85), _
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker), _
1 / ((amountFOReachAmountMarker (AmountMarker) + 1) / 36500), _
24 * (1 / ((amountFOReachAmountMarker (AmountMarker) + 1) / 36500)), _
amountFOReachAmountMarker (AmountMarker), _
MAXDEATH (20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker)), _
1 - (MAXDEATH (20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker))), _
PopulationWideYLS (AmountMarker), CancerPatientsYLS (AmountMarker), _
PopulationWideCorrespondingReduction (AmountMarker), _
AVERAGEPopulationWideCorrespondingReduction (AmountMarker), _
UnAgeAdustedOverallAVERAGECOST (AmountMarker), _
USAAgeAdustedOverallAVERAGECOST (AmountMarker), _
MammoTotal (AmountMarker), _
AgeAjustedMammoTotal (AmountMarker)
'

If amountFOReachAmountMarker (AmountMarker) > 0 Then Write #3,
INTERVALforEACHmarginalAMOUNT (AmountMarker, 20),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 25),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 30),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 35),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 40),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 45),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 50),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 55),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 60),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 65),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 70),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 75),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 80),
INTERVALforEACHmarginalAMOUNT (AmountMarker, 85), _
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker), _
1 / ((amountFOReachAmountMarker (AmountMarker)) / 36500), _
24 * (1 / ((amountFOReachAmountMarker (AmountMarker)) / 36500)), _
amountFOReachAmountMarker (AmountMarker), _
MAXDEATH (20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker)), _
1 - (MAXDEATH (20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker))), _
PopulationWideYLS (AmountMarker), CancerPatientsYLS (AmountMarker), _
PopulationWideCorrespondingReduction (AmountMarker), _
AVERAGEPopulationWideCorrespondingReduction (AmountMarker), _
UnAgeAdustedOverallAVERAGECOST (AmountMarker), _
USAAgeAdustedOverallAVERAGECOST (AmountMarker), _
MammoTotal (AmountMarker), _
AgeAjustedMammoTotal (AmountMarker)

Next AmountMarker
Close #3

```

```

' Third: we'll write the "Ratchet" file, i.e. just those values corresponding
' to round number reductions in death (i.e. 10%,20%...80%..90%)

```

```
Open "c:\My Dump\JANv3c.txt" For Output As #4
```

```
Write #4, title
```

```
Write #4, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, _  
"reduction in death", _  
"reduction in death (rounded)", _  
"return/last test (days)", _  
"return/last test (hours)", _  
"marginal cost", _  
"death fraction", "survivors", _  
"CancerFreeYls", "CancerPatients Cancer FreeYLS", _  
"USA_PopulationWideCorrespondingReduction",  
"AVERAGEPopulationWideCorrespondingReduction", _  
"UnAgeAdustedOverallAVERAGECOST", "USAAgeAdustedOverallAVERAGECOST", _  
"MammoTotal", _  
"AgeAjustedMammoTotal"
```

```
For ratchet = 0.1 To 0.9 Step 0.05
```

```
For AmountMarker = 1 To 2115
```

```
,
```

```
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
```

```
Then Write #4, _
```

```
INTERVALforEACHmarginalAMOUNT(AmountMarker, 20),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 25),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 30),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 35),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 40),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 45),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 50),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 55),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 60),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 65),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 70),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 75),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 80),  
INTERVALforEACHmarginalAMOUNT(AmountMarker, 85), _  
(UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _  
ratchet, _  
1 / (amountFOReachAmountMarker(AmountMarker) / 36500), _  
24 * (1 / (amountFOReachAmountMarker(AmountMarker) / 36500)), _  
amountFOReachAmountMarker(AmountMarker), _  
MAXDEATH(20) * (1 -  
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _  
1 - (MAXDEATH(20) * (1 -  
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), _  
PopulationWideYLS(AmountMarker), CancerPatientsYLS(AmountMarker),  
PopulationWideCorrespondingReduction(AmountMarker),  
AVERAGEPopulationWideCorrespondingReduction(AmountMarker), _  
UnAgeAdustedOverallAVERAGECOST(AmountMarker),  
USAAgeAdustedOverallAVERAGECOST(AmountMarker), _  
MammoTotal(AmountMarker), _  
AgeAjustedMammoTotal(AmountMarker)
```

```
,
```

```
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
```

```
Then GoTo 2000
```

```
Next AmountMarker
```

```
2000 Next ratchet
```

' now we'll add several lines for the recommended patterns of screening (ie ACS, UK, MGH etc)

For AmountMarker = 2001 To 2115

,

For Age = MinAGE To MaxAGE Step 5

Write #4, (IndicatedInterval(AmountMarker, Age) / 30),

Next Age

,

Write #4, \_

(UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), \_

,

,

,

,

MAXDEATH(20) \* (1 -

UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), \_

1 - (MAXDEATH(20) \* (1 -

UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), \_

PopulationWideYLS(AmountMarker), \_

CancerPatientsYLS(AmountMarker), \_

PopulationWideCorrespondingReduction(AmountMarker), \_

AVERAGEPopulationWideCorrespondingReduction(AmountMarker), \_

UnAgeAdjustedOverallAVERAGECOST(AmountMarker), \_

USAAgeAdjustedOverallAVERAGECOST(AmountMarker), \_

MammoTotal(AmountMarker), \_

AgeAdjustedMammoTotal(AmountMarker)

,

Next AmountMarker

'Now we'll add a second table, below the above one, giving the reduction in death for each age.

Write #4, ""

Write #4, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85

For ratchet = 0.1 To 0.9 Step 0.05

For AmountMarker = 1 To 2000

If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet

Then Write #4, \_

CorrespondingReduction(AmountMarker, 20), CorrespondingReduction(AmountMarker,

25), CorrespondingReduction(AmountMarker, 30),

CorrespondingReduction(AmountMarker, 35), CorrespondingReduction(AmountMarker,

40), CorrespondingReduction(AmountMarker, 45),

CorrespondingReduction(AmountMarker, 50), CorrespondingReduction(AmountMarker,

55), CorrespondingReduction(AmountMarker, 60),

CorrespondingReduction(AmountMarker, 65), CorrespondingReduction(AmountMarker,

70), CorrespondingReduction(AmountMarker, 75),

CorrespondingReduction(AmountMarker, 80), CorrespondingReduction(AmountMarker,

85) \_

, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), ratchet

If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet

Then GoTo 2001

Next AmountMarker

2001 Next ratchet

' below we'll add lines for the recommended patterns, ie. acs, uk, mgh

For AmountMarker = 2001 To 2115

```

Write #4, _
CorrespondingReduction(AmountMarker, 20), CorrespondingReduction(AmountMarker,
25), CorrespondingReduction(AmountMarker, 30),
CorrespondingReduction(AmountMarker, 35), CorrespondingReduction(AmountMarker,
40), CorrespondingReduction(AmountMarker, 45),
CorrespondingReduction(AmountMarker, 50), CorrespondingReduction(AmountMarker,
55), CorrespondingReduction(AmountMarker, 60),
CorrespondingReduction(AmountMarker, 65), CorrespondingReduction(AmountMarker,
70), CorrespondingReduction(AmountMarker, 75),
CorrespondingReduction(AmountMarker, 80), CorrespondingReduction(AmountMarker,
85)
, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), ratchet
Next AmountMarker

```

'Now we'll add a third table,below the above one,giving the YLS for each age.

```

Write #4, ""
Write #4, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85
For ratchet = 0.1 To 0.9 Step 0.05
'*
For AmountMarker = 1 To 2000
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2003
GoTo 2004
2003 For Age = MinAGE To MaxAGE Step 5
Write #4, (CorrespondingReduction(AmountMarker, Age)) * _
(INCIDENTE(Age)) * MAXDEATH(Age) * (YLL(Age)),
Next Age
Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)),
ratchet
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2005
2004 Next AmountMarker
'*
2005 Next ratchet

```

' below we'll add lines for the recomended patterns, ie. acs, uk, mgh

```

For AmountMarker = 2001 To 2115
For Age = MinAGE To MaxAGE Step 5
Write #4, (CorrespondingReduction(AmountMarker, Age)) * _
(INCIDENTE(Age)) * MAXDEATH(Age) * (YLL(Age)),
Next Age
Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)),
ratchet
Next AmountMarker

```

'Now we'll add a fourth table,below the above one,giving the AVERAGE COST for each age.

```

Write #4, ""
Write #4, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85

For ratchet = 0.1 To 0.9 Step 0.05
'*
For AmountMarker = 1 To 2000
'""
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2006
GoTo 2007

```

```

' %%
2006 For Age = MinAGE To MaxAGE Step 5
If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = "none" Then
INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = 0
x = CInt((INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) * 30))
Write #4, AVERAGECOST(x, Age),
If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = 0 Then
INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = "none"
'%%
Next Age
Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2009
'""
2007 Next AmountMarker
'*
2009 Next ratchet

' below we'll add lines for the recomended patterns, ie. acs, uk, mgh
For AmountMarker = 2001 To 2115
For Age = MinAGE To MaxAGE Step 5
Write #4, AVERAGECOST(IndicatedInterval(AmountMarker, Age), Age),
Next Age
Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))
Next AmountMarker

Close #4

' Next: we'll write the "Ratchet" file, i.e. just those values by marginal
cost
'      i.e ($1000, 2000...10000; 10000,20000...100000;
100000,20000...1,000,000)
'
Open "c:\My Dump\JANv3d.txt" For Output As #6

Write #6, title
Write #6, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, _
"reduction in death", _
, _
"return/last test (days)", _
"return/last test (hours)", _
"marginal cost", _
"death fraction", "survivors", _
"CancerFreeYls", "CancerPatients Cancer FreeYLS", _
"USA_PopulationWideCorrespondingReduction",
"AVERAGEPopulationWideCorrespondingReduction", _
"UnAgeAdustedOverallAVERAGECOST", "USAAgeAdustedOverallAVERAGECOST"

AmountRatchet = 0
For ratchet = 0 To 40 Step 1
If ratchet <= 9 Then AmountRatchet = ratchet * 1000
If ratchet >= 10 And ratchet < 20 Then AmountRatchet = (ratchet - 9) * 10000
If ratchet >= 20 And ratchet < 30 Then AmountRatchet = (ratchet - 19) * 100000
If ratchet >= 30 Then AmountRatchet = (ratchet - 29) * 1000000

For AmountMarker = 1 To 2115

```

```

'
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then Write #6, _
ratchet, _
INTERVALforEACHmarginalAMOUNT(AmountMarker, 20),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 25),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 30),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 35),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 40),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 45),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 50),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 55),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 60),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 65),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 70),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 75),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 80),
INTERVALforEACHmarginalAMOUNT(AmountMarker, 85), _
(UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
'
1 / (amountFOReachAmountMarker(AmountMarker) / 36500), _
24 * (1 / (amountFOReachAmountMarker(AmountMarker) / 36500)), _
amountFOReachAmountMarker(AmountMarker), _
MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
1 - (MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), _
PopulationWideYLS(AmountMarker), CancerPatientsYLS(AmountMarker), _
PopulationWideCorrespondingReduction(AmountMarker), _
AVERAGEPopulationWideCorrespondingReduction(AmountMarker), _
UnAgeAdustedOverallAVERAGECOST(AmountMarker),
USAAgeAdustedOverallAVERAGECOST(AmountMarker)
'

If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 2010
Next AmountMarker
2010 Next ratchet

'Now we'll add a second table, below the above one, giving the reduction in
death for each age.
Write #6, ""
Write #6, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85
AmountRatchet = 0
For ratchet = 1 To 40 Step 1
If ratchet <= 9 Then AmountRatchet = ratchet * 1000
If ratchet >= 10 And ratchet < 20 Then AmountRatchet = (ratchet - 9) * 10000
If ratchet >= 20 And ratchet < 30 Then AmountRatchet = (ratchet - 19) * 100000
If ratchet >= 30 Then AmountRatchet = (ratchet - 29) * 1000000

For AmountMarker = 1 To 2115
'
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then Write #6, _
ratchet, _
CorrespondingReduction(AmountMarker, 20), CorrespondingReduction(AmountMarker,
25), CorrespondingReduction(AmountMarker, 30),
CorrespondingReduction(AmountMarker, 35), CorrespondingReduction(AmountMarker,
40), CorrespondingReduction(AmountMarker, 45),
CorrespondingReduction(AmountMarker, 50), CorrespondingReduction(AmountMarker,

```

```

55), CorrespondingReduction(AmountMarker, 60),
CorrespondingReduction(AmountMarker, 65), CorrespondingReduction(AmountMarker,
70), CorrespondingReduction(AmountMarker, 75),
CorrespondingReduction(AmountMarker, 80), CorrespondingReduction(AmountMarker,
85), _
(UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 2011
Next AmountMarker
2011 Next ratchet

```

'Now we'll add a third table, below the above one, giving the YLS for each age.

```

Write #6, ""
Write #6, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85
AmountRatchet = 0
For ratchet = 1 To 40 Step 1
If ratchet <= 9 Then AmountRatchet = ratchet * 1000
If ratchet >= 10 And ratchet < 20 Then AmountRatchet = (ratchet - 9) * 10000
If ratchet >= 20 And ratchet < 30 Then AmountRatchet = (ratchet - 19) * 100000
If ratchet >= 30 Then AmountRatchet = (ratchet - 29) * 1000000

For AmountMarker = 1 To 2115
'
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 2013
GoTo 2014
2013 Write #6, ratchet,
For Age = MinAGE To MaxAGE Step 5
Write #6, (CorrespondingReduction(AmountMarker, Age)) * _
(INCIDENCE(Age)) * MAXDEATH(Age) * (YLL(Age)),
Next Age
Write #6, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 2015
2014 Next AmountMarker
'
2015 Next ratchet

```

'Now we'll add a fourth table, below the above one, giving the AVERAGE COST for each age.

```

Write #6, ""
Write #6, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85
AmountRatchet = 0
For ratchet = 1 To 40 Step 1
If ratchet <= 9 Then AmountRatchet = ratchet * 1000
If ratchet >= 10 And ratchet < 20 Then AmountRatchet = (ratchet - 9) * 10000
If ratchet >= 20 And ratchet < 30 Then AmountRatchet = (ratchet - 19) * 100000
If ratchet >= 30 Then AmountRatchet = (ratchet - 29) * 1000000
For AmountMarker = 1 To 2115
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 2016
GoTo 2017
'
2016 Write #6, ratchet,
For Age = MinAGE To MaxAGE Step 5

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = "none" Then
INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = 0
x = CInt((INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) * 30))

```



```

Write #6, AVERAGECOST(x, Age),
Next Age
'
Write #6, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))

If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 2018
2017 Next AmountMarker
'
2018 Next ratchet

2019 Close #6

' Now, we'll write the "Ratchet" file, based on JANv3c, but adpaetd for every
day;
'' i.e. just those values corresponding
' to round number reductions in death (i.e. 10%,20%...80%..90%)
Open "c:\My Dump\JA4cEV.txt" For Output As #4

Write #4, title
For Age = MinAGE To MaxAGE Step 1
Write #4, Age,
Next Age
Write #4, _
"reduction in death", _
"reduction in death (rounded)", _
"return/last test (days)", _
"return/last test (hours)", _
"marginal cost", _
"death fraction", "survivors", _
"CancerFreeYls", "CancerPatient's CancerFreeYLS", _
"USA_PopulationWideCorrespondingReduction",
"AVERAGEPopulationWideCorrespondingReduction", _
"UnAgeAdustedOverallAVERAGECOST", _
"USAAgeAdustedOverallAVERAGECOST", _
"MammoTotal", _
"AgeAjustedMammoTotal"

For ratchet = 0.1 To 0.9 Step 0.05
For AmountMarker = 1 To 2115
'
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then
    For Age = MinAGE To MaxAGE Step 1
        Write #4, INTERVALforEACHmarginalAMOUNT(AmountMarker, Age),
        Next Age
        Write #4,
(UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
ratchet, _
1 / (amountFOReachAmountMarker(AmountMarker) / 36500), _
24 * (1 / (amountFOReachAmountMarker(AmountMarker) / 36500)), _
amountFOReachAmountMarker(AmountMarker), _
MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
1 - (MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), _

```

```

    PopulationWideYLS (AmountMarker), CancerPatientsYLS (AmountMarker),
    PopulationWideCorrespondingReduction (AmountMarker),
    AVERAGEPopulationWideCorrespondingReduction (AmountMarker), _
    UnAgeAdustedOverallAVERAGECOST (AmountMarker),
    USAAgeAdustedOverallAVERAGECOST (AmountMarker), _
    MammoTotal (AmountMarker), _
    AgeAjustedMammoTotal (AmountMarker)
End If

If UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker) > ratchet
Then GoTo 2500
Next AmountMarker
2500 Next ratchet

' now we'll add several lines for the recomended patterns of screening (ie
ACS, UK, MGH etc)
For AmountMarker = 2001 To 2115
'
For Age = MinAGE To MaxAGE Step 1
Write #4, (IndicatedInterval (AmountMarker, Age) / 30),
Next Age
'
Write #4, _
(UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker)), _
' _
' _
' _
' _
MAXDEATH (20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker)), _
1 - (MAXDEATH (20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker))), _
PopulationWideYLS (AmountMarker), _
CancerPatientsYLS (AmountMarker), _
PopulationWideCorrespondingReduction (AmountMarker), _
AVERAGEPopulationWideCorrespondingReduction (AmountMarker), _
UnAgeAdustedOverallAVERAGECOST (AmountMarker), _
USAAgeAdustedOverallAVERAGECOST (AmountMarker)
'
Next AmountMarker

'Now we'll add a second table,below the above one,giving the reduction in
death for each age.
Write #4, ""
For Age = MinAGE To MaxAGE Step 1
Write #4, Age,
Next Age
Write #4,
For ratchet = 0.1 To 0.9 Step 0.05
For AmountMarker = 1 To 2000

If UnAgeAdjustedPopulationWideCorrespondingReduction (AmountMarker) > ratchet
Then
    For Age = MinAGE To MaxAGE Step 1
    Write #4, CorrespondingReduction (AmountMarker, Age),
    Next Age

```

```

    Write #4,
    (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), ratchet
End If

If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2501
Next AmountMarker
2501 Next ratchet

' below we'll add lines for the recomended patterns, ie. acs, uk, mgh
For AmountMarker = 2001 To 2115
Write #4, _
CorrespondingReduction(AmountMarker, 20), CorrespondingReduction(AmountMarker,
25), CorrespondingReduction(AmountMarker, 30),
CorrespondingReduction(AmountMarker, 35), CorrespondingReduction(AmountMarker,
40), CorrespondingReduction(AmountMarker, 45),
CorrespondingReduction(AmountMarker, 50), CorrespondingReduction(AmountMarker,
55), CorrespondingReduction(AmountMarker, 60),
CorrespondingReduction(AmountMarker, 65), CorrespondingReduction(AmountMarker,
70), CorrespondingReduction(AmountMarker, 75),
CorrespondingReduction(AmountMarker, 80), CorrespondingReduction(AmountMarker,
85) _
, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), ratchet
Next AmountMarker

'Now we'll add a third table,below the above one,giving the YLS for each age.
Write #4, ""
For Age = MinAGE To MaxAGE Step 1
Write #4, Age,
Next Age
Write #4,
For ratchet = 0.1 To 0.9 Step 0.05
'*
For AmountMarker = 1 To 2000
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2503
GoTo 2504
2503 For Age = MinAGE To MaxAGE Step 1
Write #4, (CorrespondingReduction(AmountMarker, Age)) * _
(INCIDENCE(Age)) * MAXDEATH(Age) * (YLL(Age)),
Next Age
Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)),
ratchet
If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet
Then GoTo 2505
2504 Next AmountMarker
'*
2505 Next ratchet

' below we'll add lines for the recomended patterns, ie. acs, uk, mgh
For AmountMarker = 2001 To 2115
For Age = MinAGE To MaxAGE Step 1
Write #4, (CorrespondingReduction(AmountMarker, Age)) * _
(INCIDENCE(Age)) * MAXDEATH(Age) * (YLL(Age)),
Next Age
Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)),
ratchet

```

Next AmountMarker

'Now we'll add a fourth table,below the above one,giving the AVERAGE COST for each age.

Write #4, ""

For Age = MinAGE To MaxAGE Step 1

Write #4, Age,

Next Age

Write #4,

For ratchet = 0.1 To 0.9 Step 0.05

'\*

For AmountMarker = 1 To 2000

'""

If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet

Then GoTo 2506

GoTo 2507

' %%

2506 For Age = MinAGE To MaxAGE Step 1

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = "none" Then

INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = 0

x = CInt((INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) \* 30))

Write #4, AVERAGECOST(x, Age),

If (INTERVALforEACHmarginalAMOUNT(AmountMarker, Age)) = 0 Then

INTERVALforEACHmarginalAMOUNT(AmountMarker, Age) = "none"

'%%

Next Age

Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))

If UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker) > ratchet

Then GoTo 2509

'""

2507 Next AmountMarker

'\*

2509 Next ratchet

' below we'll add lines for the recomended patterns, ie. acs, uk, mgh

For AmountMarker = 2001 To 2115

For Age = MinAGE To MaxAGE Step 1

Write #4, AVERAGECOST(IndicatedInterval(AmountMarker, Age), Age),

Next Age

Write #4, (UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))

Next AmountMarker

Close #4

'We'll NOW put the data we've generated into files showing every age:

' First: we'll dump into a file the curves of:

' total amount of death ("DEATHFRACTION"),versus screening interval("Today")

' reduction in death ("DEATHREDUCTION ") versus screening interval("Today"),

' marginal cost ("MARGINALCOST") versus screening interval("Today"), and

' total cost versus screening interval("Today"), each graph by age

3999 Open "c:\My Dump\EVERa.txt" For Output As #12

Write #12, title

Write #12, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, , 20, 25,

30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, , 20, 25, 30, 35, 40, 45, 50,

55, 60, 65, 70, 75, 80, 85, , 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75,  
80, 85

For Today = 1 To 3650

'Add the "If then" part of the next statement to make graphs with smaller datasets

```
If Today / 30 = Int(Today / 30) Then Write #12, Today, DEATHFRACTION(Today, 20), DEATHFRACTION(Today, 25), DEATHFRACTION(Today, 30), DEATHFRACTION(Today, 35), DEATHFRACTION(Today, 40), DEATHFRACTION(Today, 45), DEATHFRACTION(Today, 50), DEATHFRACTION(Today, 55), DEATHFRACTION(Today, 60), DEATHFRACTION(Today, 65), DEATHFRACTION(Today, 70), DEATHFRACTION(Today, 75), DEATHFRACTION(Today, 80), DEATHFRACTION(Today, 85) _  
, Today, DEATHREDUCTION(Today, 20), DEATHREDUCTION(Today, 25), DEATHREDUCTION(Today, 30), DEATHREDUCTION(Today, 35), DEATHREDUCTION(Today, 40), DEATHREDUCTION(Today, 45), DEATHREDUCTION(Today, 50), DEATHREDUCTION(Today, 55), DEATHREDUCTION(Today, 60), DEATHREDUCTION(Today, 65), DEATHREDUCTION(Today, 70), DEATHREDUCTION(Today, 75), DEATHREDUCTION(Today, 80), DEATHREDUCTION(Today, 85), _  
Today, MARGINALCOST(Today, 20), MARGINALCOST(Today, 25), MARGINALCOST(Today, 30), MARGINALCOST(Today, 35), MARGINALCOST(Today, 40), MARGINALCOST(Today, 45), MARGINALCOST(Today, 50), MARGINALCOST(Today, 55), MARGINALCOST(Today, 60), MARGINALCOST(Today, 65), MARGINALCOST(Today, 70), MARGINALCOST(Today, 75), MARGINALCOST(Today, 80), MARGINALCOST(Today, 85), Today, AVERAGECOST(Today, 20), AVERAGECOST(Today, 25), AVERAGECOST(Today, 30), AVERAGECOST(Today, 35), AVERAGECOST(Today, 40), AVERAGECOST(Today, 45), AVERAGECOST(Today, 50), AVERAGECOST(Today, 55), AVERAGECOST(Today, 60), AVERAGECOST(Today, 65), AVERAGECOST(Today, 70), AVERAGECOST(Today, 75), AVERAGECOST(Today, 80), AVERAGECOST(Today, 85)
```

Next Today

Close #12

' Second: we'll dump the table of screening schedules into a second file:

Open "c:\My Dump\EVERb.txt" For Output As #13

Write #13, title

For Zage = MinAGE To MaxAGE

Write #13, Zage,

Next Zage

```
Write #13, "reduction in death", "marginal cost", _  
"reduction in death", _  
"return/last test (days)", _  
"return/last test (hours)", _  
"marginal cost", _  
"death fraction", "survivors", _  
"CancerFreeYls", "CancerPatient's CancerFreeYLS", _  
"USA_PopulationWideCorrespondingReduction", _  
"AVERAGEPopulationWideCorrespondingReduction", _  
"UnAgeAdustedOverallAVERAGECOST", _  
"USAAgeAdustedOverallAVERAGECOST", _  
"MammoTotal", _  
"AgeAjustedMammoTotal"
```

```

For AmountMarker = 1 To 2115

For Zage = MinAGE To MaxAGE
Write #13, INTERVALforEACHmarginalAMOUNT(AmountMarker, Zage),
Next Zage
Write #13, UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker), _
    1 / ((amountFOReachAmountMarker(AmountMarker) + 1) / 36500), _
    24 * (1 / ((amountFOReachAmountMarker(AmountMarker) + 1) / 36500)), _
    amountFOReachAmountMarker(AmountMarker), _
    MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
    1 - (MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), _
    PopulationWideYLS(AmountMarker), CancerPatientsYLS(AmountMarker), _
    PopulationWideCorrespondingReduction(AmountMarker), _
    AVERAGEPopulationWideCorrespondingReduction(AmountMarker), _
    UnAgeAdustedOverallAVERAGECOST(AmountMarker), _
    USAAgeAdustedOverallAVERAGECOST(AmountMarker), _
    MammoTotal(AmountMarker), _
    AgeAjustedMammoTotal(AmountMarker)

Next AmountMarker

Close #13

' Third: we'll write the "Ratchet" file, i.e. just those values corresponding
' to round number reductions in death (i.e. 10%,20%...80%..90%)
Open "c:\My Dump\EVERc.txt" For Output As #14
Write #14, title

For Zage = MinAGE To MaxAGE
Write #14, Zage,
Next Zage

Write #14, "reduction in death", _
"return/last test (days)", _
"return/last test (hours)", _
"marginal cost", _
"death fraction", "survivors", _
"CancerFreeYls", "CancerPatient's CancerFreeYLS", _
"USA_PopulationWideCorrespondingReduction", _
"AVERAGEPopulationWideCorrespondingReduction", _
"UnAgeAdustedOverallAVERAGECOST", _
"USAAgeAdustedOverallAVERAGECOST", _
"MammoTotal", _
"AgeAjustedMammoTotal"

For ratchet = 0.1 To 0.9 Step 0.01
For AmountMarker = 1 To 2115

If PopulationWideCorrespondingReduction(AmountMarker) > ratchet Then
    For Zage = MinAGE To MaxAGE
        Write #14, INTERVALforEACHmarginalAMOUNT(AmountMarker, Zage),
        Next Zage
        Write #14,
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker), _

```

```

1 / ((amountFOReachAmountMarker(AmountMarker) + 1) / 36500), _
24 * (1 / ((amountFOReachAmountMarker(AmountMarker) + 1) / 36500)), _
amountFOReachAmountMarker(AmountMarker), _
MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
1 - (MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), _
PopulationWideYLS(AmountMarker), CancerPatientsYLS(AmountMarker), _
PopulationWideCorrespondingReduction(AmountMarker), _
AVERAGEPopulationWideCorrespondingReduction(AmountMarker), _
UnAgeAdustedOverallAVERAGECOST(AmountMarker), _
USAAgeAdustedOverallAVERAGECOST(AmountMarker), _
MammoTotal(AmountMarker), _
AgeAjustedMammoTotal(AmountMarker)

End If

If PopulationWideCorrespondingReduction(AmountMarker) > ratchet Then GoTo 4000
Next AmountMarker
4000 Next ratchet

Close #14

' NEXT: we'll write the "Ratchet" file, i.e. just those values corresponding
' to round numbers of Marginal cost
Open "c:\My Dump\EVERd.txt" For Output As #15
Write #15, title

For Zage = MinAGE To MaxAGE
Write #15, Zage,
Next Zage

Write #15, "reduction in death", _
"return/last test (days)", _
"return/last test (hours)", _
"marginal cost", _
"death fraction", "survivors", _
"CancerFreeYls", "CancerPatient's CancerFreeYLS", _
"USA_PopulationWideCorrespondingReduction", _
"AVERAGEPopulationWideCorrespondingReduction", _
"UnAgeAdustedOverallAVERAGECOST", _
"USAAgeAdustedOverallAVERAGECOST", _
"MammoTotal", _
"AgeAjustedMammoTotal"
For ratchet = 1 To 100 Step 1
AmountRatchet = ratchet * 10000
For AmountMarker = 1 To 2115
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then
For Zage = MinAGE To MaxAGE
Write #15, INTERVALforEACHmarginalAMOUNT(AmountMarker, Zage),
Next Zage
Write #15, _
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker), _
1 / ((amountFOReachAmountMarker(AmountMarker) + 1) / 36500), _
24 * (1 / ((amountFOReachAmountMarker(AmountMarker) + 1) / 36500)), _
amountFOReachAmountMarker(AmountMarker), _

```

```

        MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker)), _
        1 - (MAXDEATH(20) * (1 -
UnAgeAdjustedPopulationWideCorrespondingReduction(AmountMarker))), _
        PopulationWideYLS(AmountMarker), CancerPatientsYLS(AmountMarker), _
        PopulationWideCorrespondingReduction(AmountMarker), _
        AVERAGEPopulationWideCorrespondingReduction(AmountMarker), _
        UnAgeAdustedOverallAVERAGECOST(AmountMarker), _
        USAAgeAdustedOverallAVERAGECOST(AmountMarker), _
        MammoTotal(AmountMarker), _
        AgeAjustedMammoTotal(AmountMarker)

End If

If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 5000
Next AmountMarker
5000 Next ratchet

Close #15

' FINALLY: we'll write the "Ratchet" file, i.e. just those values
corresponding
' to round numbers of Marginal cost, for 5 yearly increments
Open "c:\My Dump\EVERe.txt" For Output As #16
Write #16, title

For Zage = MinAGE To MaxAGE Step 5
Write #16, Zage,
Next Zage

Write #16, "reduction in death", "marginal cost", "death rate", "survivors"

For ratchet = 1 To 100 Step 1
AmountRatchet = ratchet * 10000
For AmountMarker = 1 To 2115
If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then
    For Zage = MinAGE To MaxAGE Step 5
        Write #16, INTERVALforEACHmarginalAMOUNT(AmountMarker, Zage),
        Next Zage
        Write #16, (PopulationWideCorrespondingReduction(AmountMarker)),
amountFOReachAmountMarker(AmountMarker), MAXDEATH(20) * (1 -
PopulationWideCorrespondingReduction(AmountMarker)), 1 - (MAXDEATH(20) * (1 -
PopulationWideCorrespondingReduction(AmountMarker)))
    End If

If amountFOReachAmountMarker(AmountMarker) >= AmountRatchet Then GoTo 6000
Next AmountMarker
6000 Next ratchet
Close #16

7000 End

End Sub

```



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